

**ON OCCUPATIONAL DISEASES OF THE
SKIN AMONG PAINT FACTORY
WORKERS, PAINTERS, POLISHERS
AND VARNISHERS IN FINLAND**

A CLINICAL AND EXPERIMENTAL STUDY

BY

VEIKKO PIRILÄ

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HELSINKI 1947

FROM THE DERMATO-VENEREOLOGICAL CLINIC OF THE
UNIVERSITY OF HELSINKI. CHIEF: PROFESSOR
PAAVO PIRILÄ

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Licenciate in medicine

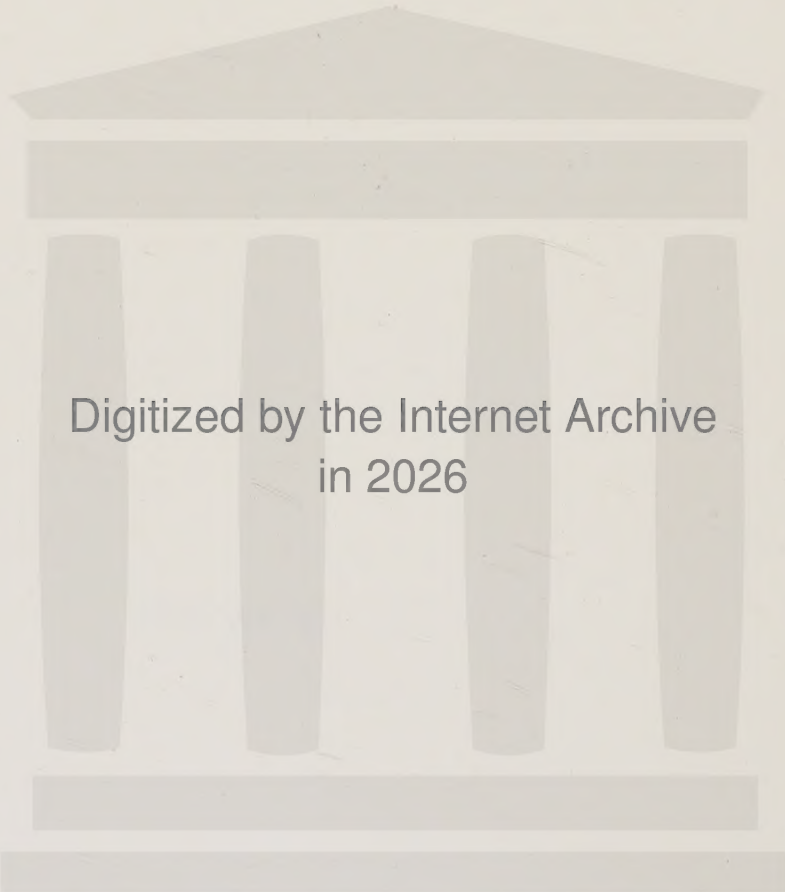
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MERCATORIN KIRJAPAINO

To my wife



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Preface.

Especially in recent years numerous patients who reported that they had acquired dermatosis in their occupations and therefore had considered it an occupational disease have been under treatment at the Department of Dermatology and Venereology of Helsinki University Hospital. A considerable proportion of these patients were painters. This fact gave rise to the idea of an investigation, on a clinical and experimental basis, of the causes of the great incidence of these dermatoses in this occupation. As it was evident that, at least for the great part, various paints and other substances used in the painter's occupation were the causal agents, it was deemed necessary to extend the study to embrace the paint factories too.

In the selection of the subject and throughout the course of this my father, Chief of the Department of Dermatology and Venereology of Helsinki University Hospital, Professor PAAVO PIRILÄ has given valuable aid. I wish to express my deep gratitude for his advice, encouragement and other support.

Without the willing help and understanding on the part of the employers and workers it would have been impossible to make the study as extensive as it is. I beg to tender my sincerest thanks to them.

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Helsinki, April 1947.

VEIKKO PIRILÄ

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PART 1

I. Occupational Diseases of the Skin.

Definition.

Under the name of occupational dermatoses are included stigmata, injuries, ulcerations, inflammations and proliferations of the skin, caused by contact with substances and other irritant agents encountered in the course of occupation. In this study, however, the author did not take into consideration actual skin injuries, if they did not result in other skin changes (inflammation etc.). Stigmata caused by occupation were not dealt with either, because of their small practical importance.

Classification.

The classification of occupational dermatoses may be made on the following grounds: 1. actual causes, 2. occupations, 3. nature of the skin changes.

The author used the first basis of classification according to SCHWARTZ:

Actual Causes.

A. Mechanical Causes

Cuts

Abrasions

Pressure

Friction

B. Physical Causes

Temperature

Heat

Cold

Electricity

Radiation

Sunlight

Roentgen

Radium

C. Chemical Causes

I. Primary Irritants

1. Primary Inorganic Irritants

Acids

Alkalis

Irritant Elements and Salts

2. Primary Organic Irritants

Acids

Solvents

Essential Oils

Acne Producers, e.g. petroleum oils, tar.

Proliferators, e.g. aniline, coal tar.

II. Sensitizers

Dye Intermediates

Dyes

Photo Developers

Rubber Accelerators and Anti-Oxidants

Soaps

Insecticides

Cosmetics

Oils

Resins

Coal Tar and Derivatives

Explosives

Plants

etc.

D. Biological Causes

Bacterial Infections
Fungi
Parasites

Classification of occupational dermatoses according to actual causes cannot be perfectly clear-cut, because, for instance, many substances are both primary irritants and specific sensitizers (e.g. turpentine, certain plants). Moreover, in many cases an occupational dermatosis develops due to the effect of several, different factors as, for instance, mechanical and chemical factors.

Nevertheless it is evident that in the painter's occupation and in paint industry the workers must handle various chemical irritants to such a great extent that the chemical factors are the chief cause of the dermatoses in these occupations. Therefore the author considered it pertinent to give a survey of the most important coating materials.

II. Coating Materials.

Paints, Varnishes and Lacquers.

The word paint in its broadest sense denotes all the materials in liquid form used for treating surfaces (paints, enamels) which when applied thinly on a surface form within a definite time a dry continuous, strong, beautifying or protective film over it.

In everyday language the word painting is used to mean applying a coating composed of materials containing pigments for the purpose of forming an opaque film. Whereas, when the coating material is transparent and does not contain a pigment, varnishing is the term used.

In general, paint is a mixture of several substances. Its ingredients may be divided into three groups: 1. binders, 2. colouring materials or pigments, 3. solvents. The most important part of a paint is the binder, which forms the film. Its function is to bind the particles of colouring material together and to the support. The

function of the solvent is to give the paint a suitable consistency for brushing or spraying, after which it evaporates from the painted surface. Coating materials only consisting of binder and solvent form a transparent film. When colouring material or pigment is added, they have the property of obscuring the surface to which they are applied.

The number of substances used in paints being very great, it is not the author's aim to give a comprehensive list of them, but to mention the most important ones used in Finland at this time.

The drying process of the paint is based either on the evaporation of the solvent or on chemical reactions. In the following coating materials are grouped according to drying process, solvents and binders.

I. Coatings Drying Chiefly, as a Result of the Evaporation of the Solvents.

1. The Chief Solvent Is Water.

a) The Vehicle Is an Inorganic Substance.

Whitewash is slaked lime suspended in water. A part of the calcium hydroxide is dissolved, but the great part is not. The dissolved calcium hydroxide functions as the binding agent. Calcium carbonate is formed through the influence of the carbon dioxide in the air. The non-dissolved part of the calcium hydroxide forms the white pigment. Whitewash is alkaline.

Silicate paints contain alkali silicate, mostly potassium silicate, as binding material.

b) The Vehicle Is Organic.

In the glue paints bone or skin glues are generally employed as binders in our country. The so-called vegetable glues made from starches also serve this purpose. Chalk is the most commonly employed pigment in these paints.

The name cold water paint is usually applied to paints, intended for out-of-door use, which contain, besides the pigment mixed in the water, some metallic salt (iron or copper sulphate) for the purpose of improving the wearing quality of the wood. Their usual vehicle is rye flour paste, into which a small amount of

boiled linseed oil is sometimes mixed to form an emulsion. Casein paints also come under the heading of cold water paints. They consist of some alkali such as lime in addition to casein and pigment. From this mixture a water-paint is obtained by adding cold water, with the result that the alkali salt of the casein dissolves.

In emulsion paints water is used to serve as a part of the solvents. As binder they contain oil or varnish, which is insoluble in water, and is suspended in it in small drops. To improve the stability of the emulsion they further contain an emulsifier, soluble in water, usually glue or casein.

2. Organic Liquids Used as Solvents.

Natural resins or synthetic resins and amorphous substances found in nature are used as binding mediums.

a) Spirit Varnishes.

Spirit varnishes are alcoholic solutions of resins. Besides ethyl alcohol, others such as butyl alcohol, diacetone alcohol etc. are used as solvents. Numerous resins are employed, and the characteristics of the films formed vary considerably.

Colophony or rosin is a product obtained in the refining processes of balsams chiefly collected from *Pinus palustris* and *Pinus maritima*. Turpentine is distilled off from the balsam by means of steam, leaving rosin as a residue. It is also produced by distillation from the part of trees containing the most balsam, that is the stumps. Colophony, the natural resin chiefly used in industry, is composed of several resin acids, abietic acids.

Copal is the name given to a large variety of fossil or recent resins, from which the best varnishes were earlier produced, but nowadays they are to a great extent replaced by synthetic resins. Manilla copal is the commonest spirit varnish resin.

Shellac, the only animal resin, is the secretion of the lac insect. A certain trioxypalmitic acid (aleuritic acid) is an important component in it, but otherwise its composition is not thoroughly known. It is mainly used in spirit varnishes and furniture lacquers.

Dammar, acaroid, benzoin, sandarac, mastic and amber, which play a very small role in present varnish industry, are also natural resins.

There are synthetic resins for both volatile and oil varnishes. Phenolic, urea and vinyl resins are the most important in the production of volatile varnishes.

The phenolic resins are condensation products of phenol and formaldehyde. Durophen, Luphen etc. fall in this group. Urea resins are produced by the condensation of urea and formaldehyde, e.g. Plastopal. The vinyl resins are the polymers of vinyl derivatives, such as vinyl acetate and vinyl chloride, e.g. Mowilith, Gelva. Coumarone is a synthetic resin formed by polymerization from coal tar. Volatile varnishes are obtained by dissolving these synthetic resins in alcohol and other solvents.

b) Cellulose Lacquers.

Cellulose nitrate, generally but incorrectly termed «nitrocellulose», is the film-former in these lacquers. Other derivatives of cellulose, such as cellulose acetate, benzyl- and ethyl cellulose are used for special purposes. These lacquers frequently contain natural or artificial resins. The solvents most commonly used are the esters: ethyl acetate or butyl acetate etc. and in addition alcohols and hydrocarbons may also be used as cheaper diluents. A pure cellulose nitrate solution has poor adherence and forms a brittle film, wherefore softening substances must be added. Solvents having a comparatively high boiling point serve this purpose, e.g. dibutyl phthalate, tricresyl phosphate. Most of the cellulose lacquers are applied to the surfaces by spraying or by submerging the article in the lacquer. Brushing is difficult because the film dissolves in the solvent mixture.

c) Special Varnishes.

A coating highly resistant to chemicals can be obtained with chlorinated rubber varnish employed particularly in the chemical industry to prevent the corrosion of metallic surfaces.

Asphalt varnishes, which contain bitumen dissolved in aliphatic hydrocarbons (such as white spirit, sangajol), turpentine and solvent naphtha, are generally volatile. They are used for instance to prevent iron from rusting. In addition to the petroleum bitumen, many other components are used in these varnishes, such as coal-tar pitch, stearine pitch etc.

II. Coatings Drying as a Result of Chemical Reactions Taking Place in the Binding Mediums.

1. Oils Used in the Varnish Industry and Paints.

Drying oils are the oldest and still the most commonly used binding mediums in paints. The most important of them is linseed oil, which is hardly used at all as such in paints, its drying rate not being fast enough, but it is refined in various ways. The most usual refining process is the making of boiled oil. Other products are stand oil, «bis oil» and «factor oil».

Boiled linseed oil is made by dissolving siccatives in raw linseed oil heated to 110—150° C. The siccatives are metallic salts acting as catalysts, cobalt, lead and manganese compounds being the most commonly used. Stand oil is produced by heating linseed oil for several hours at a temperature of 280—300° C. It cannot be applied without thinning, wherefore solvents must be added.

Other oils too are used together with linseed oil or alone in making varnishes and paints. The most important one in Finland is tall oil, which is obtained as a by-product in the sulphate cellulose industry. It chiefly consists of fatty and resin acids. A tall oil varnish, which contains siccatives and turpentine as diluent, is made of it. Rape seed oil and mustard oil are to a certain extent used to replace linseed oil.

Oil paints, which the painter mixes in situ, are made from boiled linseed oil. In addition to the latter and pigments they also frequently contain siccatives, whereas diluents are seldom used, but the above-mentioned special oils are often added.

2) Oil Varnishes and Oil Enamels.

In enamels the film is formed by a drying oil and synthetic resin mixture, to which are added diluents and siccatives.

The chief synthetic resins used are modified phenol formaldehyde resins (e.g. Albertol, Amberol), maleic acid resins and alkyd resins. The two first mentioned, which have colophony as one ingredient, are called synthetic copals. The use of maleic acid resins in Finland is very small. Alkyd resins (e.g. Beckosol, Glyptal) are made from phthalic anhydride, glycerine or pentaerythritol and drying or non-drying oils. In manufacturing varnishes resins are dissolved in the

oil by heating to 280° C, whereat a chemical reaction takes place. In the superior quality varnishes China wood oil is used in addition to the common drying oils.

In oil enamels various oil varnishes and stand oil serve as vehicles. Depending on the proportion between the pigment and vehicle, either glossy or flat coatings are obtained.

Putty is used to smooth an uneven surface for painting. The most commonly employed putty in the building trade is the so-called stopper, which is made of boiled linseed oil, paste and chalk.

Pigments.

The pigments incorporated in coating materials may be classified as follows (KIRJAKKA):

Inorganic Pigments.

a) Earth pigments are derived from minerals, ores and sedimentary deposit of the earth's crust, either suitable for use as pigments in their natural state or after purification. Examples of these are ochres, umbers and sienna.

b) Mineral pigments, which are obtained from minerals in nature by suitable processes, e.g. barytes, gypsum, iron oxide.

c) Synthetic inorganic pigments, such as zinc oxide, lithopone, ultramarine.

Organic Pigments.

Nowadays the artificial organic pigments have completely replaced the natural ones earlier in use. They are used in paints mixed with inorganic inerts, so called extenders. These pigments are prepared from:

a) soluble organic dyes by precipitation with inorganic salts, in which process the inorganic extender is simultaneously precipitated. Colour lakes, insoluble in water are produced in this way.

b) insoluble organic pigments by mixing them with extenders.

I. Inorganic Pigments.

Nearly all inorganic pigments are metallic compounds or, at least, compounds of elements which have the property of metals to act as cations. Therefore it is practicable to classify these pigments according to the cations on a chemical basis (WAGNER).

1. Alkaline Earth Metals.

a) Calcium compounds: calcite, marble, limestone and chalk (various forms of calcium carbonate), gypsum (calcium sulphate), limewater, mortar (calcium hydroxide), fluor spar (calcium fluoride).

b) Barium compounds: baryte, permanent white, blanc fixe (barium sulphate), barium yellow (barium chromate), barium hydroxide.

c) Strontium pigments are not of any great importance: strontium chromate.

2. Zinc Group.

a) Talc (magnesium silicate) is the most important one of the magnesium compounds.

b) Zinc pigments: zinc oxide, lithopone (mixture of zinc sulphide and barium sulphate), zinc yellow (zinc chromate), zinc green (mixture of zinc yellow and Prussian blue).

3. Cadmium Group.

a) Cadmium pigments: cadmium yellow and orange (cadmium sulphide), cadmium red (cadmium sulpho-selenide).

b) Mercuric pigments: cinnabar or vermilion (red mercuric sulphide).

4. Copper Group.

Aluminum, though completely differing from copper chemically, is included in this group for practical purposes, because it is also used in manufacturing alloys giving a metallic lustre, bronze-powders.

a) Aluminum pigments: aluminum bronze, kaolin or China clay (aluminum silicate), ultramarine green, blue and other ultramarine pigments (prepared by heating China clay with carbonate of soda, sulphur and coal).

b) Copper pigments: malachite (a basic copper carbonate), emerald green or Paris green (copper aceto-arsenite), copper sub-oxide.

5. *Titanium Group.*

a) Titanium pigments: titanium dioxide, ilmenite black (iron titanate).

6. *Lead Group.*

a) Lead pigments: red lead and other lead oxides, white lead (basic carbonate of lead), basic lead sulphate, chrome yellow, chrome orange, chrome red (different lead chromates).

7. *Chromium Group.*

a) Chromium pigments: the various chromate pigments are given under respective cation metals. Chromium oxide green (chromium oxide), Guignet's green (hydrous oxide of chromium).

8. *Iron Group.*

a) Manganese pigments: umbers are products obtained from iron and manganese ores. In comparison with these, pure manganese pigments are of negligible importance.

b) Iron pigments: yellow ochre, red ochre and sienna are natural earths chiefly containing iron oxides and are used either as such or burnt, e.g. oxide red of iron. Yellow iron oxide, red iron oxide, caput mortuum as well as black iron oxide are corresponding synthetic iron pigments. Prussian blue, Paris blue and Turnbull blue (ferric ferrocyanide compounds), chrome green (mixture of chrome yellow and Prussian blue), zinc green (mixture of zinc yellow and Prussian blue).

c) Nickel pigments: nickel compounds are hardly used at all as pigments in paints.

d) Cobalt pigments: cobalt blue (cobalt aluminate), cobalt green (compound of cobalt oxide and zinc oxide).

9. *Carbon and Silicon Group.*

a) Carbon pigments: graphite, brown coal, Van Dyke brown and asphalt are the most important of the natural carbons used as pigments. Bone black, coke black, lamp black, gas black etc. are obtained by dry distillation of the respective organic substances.

b) Silicon pigments: silicon compounds are mainly used as extenders for other pigments. Quarz (silicon dioxide), kaolin or China clay and other silicates.

10. Arsenic Group.

a) Arsenic pigments: nowadays arsenic pigments are scarcely used at all because of their toxicity. The most important one of these is Paris green, already mentioned under the copper pigments.

b) Antimony pigments: antimony white (antimony oxide).

II. Organic Dyes and Pigments.

The clearest classification of the organic dyes, just as of the inorganic, can be made on the basis of their chemical compositions. I shall make use of TALVITIE's classification, which comprises five great groups and a sixth group consisting of dyes and dye groups not included in the former groups. The examples cited in each group are chiefly dyes having significance in Finland in the preparation of pigments, and dyes which are known, on the basis of earlier research, to cause dermatoses. Further, the list includes some textile dyes which the workers in Finnish paint factories must handle.

1. Triphenylmethane Group.

They are derivatives of triphenylmethane $(C_6H_5)_3CH$. E.g. alkaline blue, auramine, brilliant blue, eosine, erythrosine, fuchsin, malachite green, methyl violet, rhodamine, spirit blue, water blue, Victoria blue.

2. Azo Group.

Azo dyes are characterized by the presence of the azobenzol group $C_6H_5-N=N-C_6H_5$, which is the chromogen of these dyes. Examples: anthosine, Bismarck brown, fast yellow, Hansa yellow, Congo brown, Congo blue, chrysoidine, Martius yellow, metanil yellow, naphthol green, naphthol red, naphthol yellow, orange I, II, III, IV, parared, ponceau, rubine, Sudan black, Sudan blue, Sudan orange, Sudan brown, Sudan yellow, Sudan red, scarlet red, toluidinetoner.

3. Anthracene Group.

Antraquinone is the chromogen in anthracene dyes. Their use as dyes or as raw material in preparing pigments is very small in Finland. Examples: alizarine, green P.L.X., helio fast blue, indanthrene dark blue R, indanthrene violet R and RR.

4. Indigo Group.

The dyes of this group are chiefly used in dyeing textiles. The most important one is indigo.

5. Sulphur Group.

The sulphur dyes are mainly used for dyeing cotton. Immedial black.

6. Miscellaneous Organic Group.

A number of dyes used as pigments do not fall in the above groups. Examples: aniline black, fast blue, induline, methyl blue, monastral blue (phthalocyanine blue), nigrosine, safranine.

Organic Solvents.

I. Hydrocarbons.

1. Aliphatic Hydrocarbons.

Benzine, white spirit (varnolene, varsol, sangajol), kerosene.

2. Alicyclic Hydrocarbons.

Particularly of late years turpentine has been the most common diluent and solvent of oil varnishes and paints in Finland. Turpentine consists chiefly of terpenes, which are polymers of isoprene (C_5H_8). The main part is formed of so-called terpenes proper ($C_{10}H_{16}$), which differ from one another in structure with respect to number of rings and of double bonds and physically as to their different boiling points. The most important ones are the bicyclic α -pinene (B.P. $156.2^\circ C$), of which there are two isomeric forms, dextro-rotatory and laevo-rotatory, β -pinene (B.P. $165.2^\circ C$) and Δ_3 -carene (B.P. $171.8^\circ C$). Dipentene (B.P. $176^\circ C$) is a rasemic mixture of two optically active limonenes, and silvestrene (B.P. $177^\circ C$) is a monocyclic terpene like limonene. Furthermore, turpentine contains small quantities of other terpenes, alcohols, aldehydes, ketones, esters and other substances.

The composition of turpentine varies according to its source and methods of production, wherefore turpentines may be divided in three main types. 1. Balsam turpentine is obtained from the balsam of pines by steam distillation. It is termed, according to place of manufacture, American, French, Russian, Austrian, German, etc. turpentine. It is not produced in Finland to any notable extent. The balsam turpentine contains pinene in particularly great abundance, even more than 90%. 2. Sulphate turpentine is obtained as a by-product in the sulphate cellulose industry. It contains about 55% α -pinene and 25% Δ_3 -carene. 3. Kiln turpentine or wood turpentine made by the destructive distillation of pine tree stumps contains only 15 to 20% α -pinene, 25 to 30% Δ_3 -carene, because a great part of the pinene is by distillation converted into dipentene.

Noulene is obtained as a by-product when lubricating is prepared from turpentine. Besides terpenes, it contains cymene.

3. Aromatic Hydrocarbons.

They are chiefly used as thinners in synthetic resin varnishes and cellulose lacquers. Benzol, toluene, xylene, cymene, solvent naphtha, tetralin (tetrahydronaphthalene), decalin (decahydronaphthalene).

4. Chlorinated Hydrocarbons.

Trichlorethylene, dichlorethane and carbon tetrachloride.

II. Alcohols.

Alcohols are the chief diluents in spirit varnishes. The most common are methyl, ethyl, propyl and butyl alcohols. They are denatured for instance by benzol, turpentine and pyridine. Pyridine (C_5H_5N) is found in coal-tar, from which it is obtained by distillation.

III. Ketones.

The most important ones are acetone and methyl ethyl ketone.

IV. Esters and Ethers.

The most important esters are methyl, ethyl, propyl and butyl acetates. Cellosolve, which comes under ethers is being more and more used.

»*Thinner*» is a diluent, which is used in the application of cellulose lacquers. It contains varying amount of amyl, butyl and ethyl acetates, alcohols, benzol and its derivatives.

»*Mineral turpentine*» or »*turpentine substitute*» are terms broadly used especially in medical literature dealing with solvents to denote several altogether different types of organic solvents, mentioned above. White spirit (sangajol, varnolene), solvent naphtha, decalin, tetralin etc. Oils chiefly containing terpenes obtained as by-products in processing camphor out of turpentine, have also been used as substitutes for turpentine (e.g. hydroterpene).

III. Survey of the Literature.

A. General Part.

Dye factories. In different countries numerous studies have been made on dermatoses occurring among the workingmen in dye factories. GRANDHOMME (1883), physician at »Hoechst» Dye Factory reports the following cases of dermatoses during a period of four years: in the alizarine plant 13, in the aniline plant 55, in the acid plant 1, in artisans 9 and outdoor workingmen 6 cases. GRANDHOMME, particularly, emphasizes the abundance of dermatoses in the aniline plant, in which there were approximately the same number of workingmen as in the alizarine plant. No mention is made in this investigation of dermatoses caused by finished dye products. BLASCHKO (1891) reports that the workers at an aniline plant acquired dermatoses chiefly from corrosive acids, bases and salts, as well as from intermediate products. He holds that, in general, finished products are innocuous. Nevertheless he mentions that at least crystal green, crysoidine and Bismarck brown may cause dermatoses. LEYMANN (1910) found that about 8% of the dye workers of an aniline plant yearly suffered from dermatoses. He reports most cases to have occurred from 1899 to 1901, when a great deal of soda and chloride of lime was used for removing dye from the hands. He considers that the dermatoses arose, besides from the latter two substances, also from nitrobenzene,

aniline, nitrochlorobenzene and other intermediate products as well as from certain dyes, which he does not specify. His opinion is that individual sensitivity plays a great role in the development of dermatitis. BACHFELD (1920) reports that during a period of six years he found a yearly average of 3.2% of the workingmen at a certain dye factory to have dermatoses resulting from their occupation. Most of these cases occurred among the workingmen dealing with the raw materials (2.3%) and those preparing dyes from the intermediates (4.0%), and considerably less in the dye mixing plants and in the dyeing shops (0.9%) and among other workingmen (0.3%). According to BACHFELD over a half of the dermatoses had arisen from the cleansing of the hands and only a small fraction from the work itself. Only two cases had, to his mind, surely been caused by finished products (impurities in dye mixtures and fast marine blue?). According to SCHWARTZ & TULIPAN (1939) an investigation conducted by the Public Health Service among 2,500 workingmen in the dye and chemical industry brought to light that 7% in a year suffered from dermatoses due to their occupation. This figure does not include actual corrosions or infected wounds got accidentally. Moreover, SCHWARTZ & TULIPAN reported that of the cases of illness and injury among 3,800 workers in the dye industry 15% were dermatoses, of which over 50% had been caused by acids or other corrosive substances. Next to the latter, intermediate products, most frequently dinitrochlorobenzene, had given rise to the greatest number of dermatoses. Finished colour products were of considerably less significance in this respect.

In summarizing previous investigations, it can be seen that in general a considerably smaller incidence of dermatoses has been found in the mixing plants which approximately correspond to the Finnish paint factories than in the dye factories proper which manufacture dyes. The most common cause of the dermatoses has been the cleansing materials or solvents, but the colouring materials themselves in very rare cases.

Painters. There is a great incidence of dermatoses among painters, a fact which is confirmed by the vast literature on the subject. The following survey contains information about cases of these diseases and about tests made on the patients with coating mate-

rials. The literature, however, does not make mention of thorough investigations in large paint shops and the wide circle of painters encompassing the various harmful factors to be taken into consideration in this occupation. BLUMENTHAL & JAFFÉ (1929) verified 7 cases of dermatitis caused by bakelite varnish, which contains a phenol formaldehyde resin, the causative agent in these cases. MUNKWITZ (1937) reports cases of dermatitis among lacquer users arising from solvents (toluene, benzine and hydroterpene). Similarly RIEDEL (1940) claims that the cause of certain cases of dermatitis occurring in a varnish and lacquer factory was benzol. Boström on studying the harmful effects of Swedish wood turpentine 1930 to 1935 found 172 workers, most of whom were painters, suffering from dermatitis. He performed patch tests on 45 patients, from which he obtained positive reactions to Swedish turpentine in 75%, to French turpentine in 33%, to mineral turpentine (varnolene) in 1 and to linseed oil in 1 of the cases. Aniline and soda did not elicit a single positive reaction. In order to find out the effect of Swedish wood turpentine also RUNDBERG (1937) examined 450 painters from 40 different shops. He reports 110 eczema cases (= 25%). Patch tests were made on 43 of them with different brands of turpentine in 40% dilution, positive reactions resulting in 24 cases. SCHWARTZ & TULIPAN report that 3% of the compensated cases of occupational skin diseases are in painters.

Spray painters. SMYTH's material comprising spray painters has 12 cases of dermatitis, three of which he holds to have caused by cleansing the hands with turpentine. KOEHLER too (1942) emphasizes the role played by unsuitable cleansing substances in the etiology of the dermatitis of three spray painters. Further, benzol and its homologues must be taken into consideration as causative agents in the dermatoses of spray painters, though, in general, they more frequently bring about general toxic symptoms rather than the former (BERING & ZITZKE).

Polishers. Varnishes or lacquers often cause dermatitis amongst polishers. Diagnoses of 25 cases of eczema among 1,328 polishers in Austria were made in 1920. Methyl alcohol and turpentine were used for the denaturing of alcohol (KOELSCH). KOELSCH (1921) himself reports dermatosis in 12% of 72 furniture polishers and in

5.8% of 260 polishers of mouldings. It appeared chiefly between the fingers. VEDROV (1928) found that 40% of the polishers examined by him had acute dermatitis on the hands, fingers and arms. He concluded that shellac and turpentine added to the french polish were the causal factors. LJUBLINSKIJ (1932) reports dermatosis, which in several cases also spread to the face, in 6 polishers as well as 5 other workers in a furniture factory. Relapses were numerous. To avoid these SIROTA (1934) reports that he has treated dermatosis cases in 21 polishers with desensitization therapy. In nine of the patients there was a slight relapse during the first months after the treatment, but they were nevertheless able to resume their work later and were quite well without break for three years.

B. Dyes and Pigments.

Dyes and pigments can injure the skin mechanically in the form of dust, by irritating the epithelium to proliferation or by affecting it in the manner either of a primary irritant or a specific sensitizer.

The effect of pigment dust. Above all the workers of pigment and dye factories are subject to the harmful effect of pigment and dye dust, wherefore diseases resulting from it are most often found among them. TURNER (1921) presents a number of occupational dermatosis cases in a zinc oxide factory. The disease is based on the blocking up of the glands by zinc oxide and on secondary infection. The result is a papulo-pustular eruption in the regions of the pubes and the scrotum, the inner surface of the thighs and less often in the axillae and arms. Profuse sweating aggravates the injurious effect of the dust. The aniline dyes too have same effect if a sufficient amount spreads on the skin (BLASCHKO, GRANDHOMME, HERXHEIMER, SACHS).

Epithelium proliferation. Soot can injure the skin not only mechanically, as described above, but also by irritating it to proliferation, which eventually may develop into cancer of the skin (SACHS). In general this disease does not, however, develop to this extreme except in occupations where the skin comes in contact

with soot exceedingly often, e.g. chimney-sweeps (Porr 1775 and others). Also aniline dyes can cause similar changes in the skin. According to SACHS (1913) acne and papilloma formation are found most frequently alongside of dermatitis and eczema. Epitheliomas are considerably rarer. SACHS gives several case reports in which the symptoms are dermatitis, eczema and papillomas. The first two he considers to be for the great part caused by the turpentine handled at the same time, whereas the third symptom he holds to be due to aniline dyes. His experiments confirm this conception: aniline dyes caused a notable proliferation of Rete Malpighi and of the sebaceous glands and often thickenings of the skin like warts or epitheliomas. The control tests with Prussian blue, cinnabar and sienna, on the contrary gave only negative results. FISCHER, HANTHAUSEN and others have come to conclusions corroborating the foregoing. Inhalation of aniline vapours has been found to have caused carcinoma, particularly in the mucous membrane of the bladder (LEUBENBERGER, LEWIN, REHN, LEICHTERNSTERN, FRAENKEL).

The toxic effect and the specific sensitization. Dyes and pigments in their pure forms have not, in general, a toxic and irritating effect on healthy skin. Especially organic dyes are regarded as entirely innocuous in this respect (SACHS, SCHWARTZ & TULIPAN and others).

Inorganic pigments. A few of the inorganic pigments have corrosive properties. BURCKHARDT (1933 and 1938) particularly has made a study of the effect of lime (CaO and Ca(OH)_2) on normal and on skin diseased by lime eczema (masons' eczema). In making tests on dry skin with lime or slaked lime he never obtained a positive reaction, but a suspension of slaked lime in water had a distinctly corrosive effect. A 25% suspension produced a toxic reaction in 55% of the healthy individuals, whereas all of the diseased reacted. The lime brought forth a definitely allergic reaction in only one of the latter group, who however reacted in the same way to sodium hydroxide too, wherefore calcium hypersensitivity could not be in question, and BURCKHARDT supposes the antigen to have been developed secondarily owing to the effects of the toxic alkali reaction. He is of the opinion that the patch test is of no particular

importance in verifying masons' eczema, for if low concentrations (1—10%) are used reactions are not always elicited even in certain cases, moreover the reaction cannot be considered specific. And if the patch test is made with a stronger calcium hydroxide suspension the healthy skin reacts too. The main emphasis in diagnosing should be put on a typical anamnesis (the effect of a sufficient contact with lime mortar and cement on the skin) and the clinical symptoms of the disease, in which the typical alkali changes (corrosions, fissures and inflammation of the nail fold) are joined with the symptoms of chronic eczema.

Paris green, containing arsenic and known for its general toxic effect, can for instance in wallpaper hangers cause the hair to fall and the nails to shed etc. (OPPENHEIM) and irritate and corrode the skin, particularly the mucous membrane of the nose. OPPENHEIM, URBACH and others have described chronic eczema attributable to sensitization to arsenic. Though soluble alkali chromates often cause corrosions of the skin and mucosa, workers handling chromium pigments do not in general have these symptoms (SCHWARTZ & TULIPAN). KOELSCH however reports such cases for instance in the wallpaper industry.

As the painters' pigments are insoluble compounds or their mixtures they have not the same harmful effect on the skin as the soluble salts of the respective metals. BLUMENTHAL & JAFFÉ, ROSTENBERG & SULZBERGER and others have demonstrated that e.g. the irritating effect on the skin of a mercury salt depends upon its dissolving and ionization capacity. Thus hypersensitive skin reacts considerably more strongly to soluble mercury salt, e.g. mercuric chloride (corrosive sublimate), than to insoluble mercurous chloride (calomel), which for instance BONNEVIE considers can be used as such in skin tests. For this reason the effect of different soluble metallic salts on the skin cannot be applied to pigments, unless they too have proved to have a corresponding effect on the skin.

Because of the general toxicity of lead, lead pigments and other lead compounds have been designated as causal agents in dermatoses (BREZINA, KOELSCH, PERUTZ, STERNBERG, TELEKY). The changing of the colour of the skin to slate grey, so-called »lead colorite», is

in general regarded as a symptom of lead poisoning (KOELSCH, BAADER etc.). LEGGE & GOADBY (1921) report cases of lead dermatitis in painters. KAZDA (1923) found gangrene in three typesetters in the right leg, the cause of which he surmises to be thrombosis due to lead poisoning. HEIM, AGASSE-LAFORT & FEIL (1923) claim that lead effects occupational diseases, especially kidney troubles, in painters more frequently than turpentine.

LANGER (1932) reports that he obtained a positive skin reaction with a paint containing white lead but not with the turpentine mixed in it. No skin tests having been made with the other ingredients of the paint, the case cannot be held to be one of definite lead hypersensitivity. But GUGGENHEIM (1933) reports that he got an eczema reaction with lead compounds in one lead worker suffering from eczema, likewise BONNEVIE (1939) with 2% lead acetate. Concluding from investigations, hypersensitivity to lead is extremely rare.

Despite the general occurrence of hypersensitivity to mercury (BLUMENTHAL & JAFFÉ 6—7%, BONNEVIE 7—8% of all cases of hypersensitivity) no conclusive statements on hypersensitivity caused by cinnabar or other mercuric pigments appear in the literature. This may for the great part be due not only to the insolubility of these substances but also to their relatively limited use. Also dermatoses owing to chromium pigments occur rather seldom compared to the commonness of chromium allergy (BONNEVIE 5—6%). Here and there is, however, mentioned of dermatoses arising from »zinc green», a derivative of chromium. In BONNEVIE's material a total of 43 cases of hypersensitivity to chromium are to be found, 7 of which were held to be due to chromium pigments. KOEHLER, on the contrary (1942), reports that not a single one of his cases of occupational dermatoses in 40 painters was caused by chromium pigments. The term »zinc green» has also been applied to a certain cobalt pigment. A positive reaction to this pigment in one painter's apprentice who had used it, gives BONNEVIE reason to suspect the agency of cobalt in his dermatosis. However, the patient reacted to chromium at the same time.

Other inorganic pigments are considerably less active than the foregoing, or their use is so negligible (nickel pigments) that they

are not in general taken into consideration as causal factors in dermatoses. Sensitization to the metals (Na, K, Ca, Mg, Fe) normally present in the organism can scarcely be thought of, nor has hypersensitivity to the corresponding pigments been observed. FLANDIN, RABEAU & UKRAINCZYK (1936) mention an exceptional case of dermatosis which titanium white had caused. KOELSCH observed that cyanide causes eczemas in galvanizers and workers in the jewellers' trade. Ferrocyanide pigments (Prussian blue etc.) have not, however, been found to have caused dermatoses, which BONNEVIE explains as depending upon the cyanide group being united with iron in a complex chemical compound. It has not been possible to verify hypersensitivity to silicates. In studying masons' eczemas, BURCKHARDT (1938) did not obtain a positive skin reaction in a single case to calcium silicates, important ingredients in cement. Though it has been held that the salts of antimony acid have sensitization capacity (ROSTENBERG & SULZBERGER, BONNEVIE), the same does not seem to have been observed with respect to the corresponding antimony pigments. Barium, cadmium, aluminum, copper, zinc, manganese, bismuth pigments and many other paint pigments have not been observed to cause eczemas (KOEHLER etc.). Some of the corresponding metals have, however, used in another form been found to produce hypersensitivity, though seldom. SEEBERG has diagnosed hypersensitivity to duraluminum, ROSTENBERG & SULZBERGER to soluble copper salts and BLUMENTHAL to bismuth (salve or grease paint containing bismuth). And zinc, either as a metal or in one of its salts, usually the chloride, may very rarely cause a dermatitis in persons occupationally exposed, particularly welders (FREEMAN).

Organic dyes. Also the majority of the organic dyes are innocuous to the skin (SACHS, BACHFELD, MAYER, SCHWARTZ & TULIPAN and others). Only a few individuals get dermatoses from them. As a matter of fact many of these dyes are even used in skin treatment. In particular certain soluble organic dyes have however caused dermatoses in a number of cases due to hypersensitivity. Among others, BUSCHKE & OLLENDORF, LEDERMANN, MAYER, SUCHIER and SCHWARTZ have diagnosed eczema and dermatitis cases caused by fur and leather dyes (paraphenylenediamine etc.).

POROSZ, NEMITZ, SIMON & RACKEMANN, BERING & ZITZKE, BONNEVIE & GENNER, NADEL, LOMHOLT and some others have reported cases of dermatosis caused by textile dyes. Cases of hypersensitivity to cosmetic colours have been presented by INGRAM, RATTNER, BOSTRÖM, SULZBERGER, GOODMAN, BYRNE & MALLOZZI, BONNEVIE, PUTKONEN and others. However SULZBERGER & HECHT proved that in some instances impurities, rather than the dye itself are the agents.

The number of the organic dyes which have been found to have caused dermatitis amounts to about 100 according to the literature. Only a small fraction of these belong to the insoluble pigments used by painters or to their organic ingredients. According to BERING & ZITZKE (1935) insoluble pigments do not cause any dermatoses at all. However, some originally soluble dyes, from which colour lakes are produced by precipitation with metallic salts, are known to cause hypersensitivity (WEIL, SACHS, WHITE, O'DONOVAN, SCHWARTZ & TULIPAN and others). At least the following triphenylmethane dyes have been observed to have caused dermatoses: auramine yellow, brilliant green, eosine, erythrosine, Victoria blue. The following azo pigments have been considered causes of dermatoses: Bismarck brown, azo yellow, chrysoidine, martius yellow, metanil yellow, naphthol green, naphthol red, naphthol yellow, orange I and II, parared. Among the anthracene pigments indanthrene violet (R and RR) and dark blue (R) have caused dermatoses. Also the following dyes used in the preparation of organic pigments have been mentioned as causal agents of dermatoses: fast blue, induline, methyl blue and safranine. The numerous dyes mentioned in the literature are called by the patented trade names of the different factories, wherefore it is often very hard to know what dye is ment in each case.

C. Binding Materials or Vehicles.

Natural resins. Statements in the literature with regard to dermatoses caused by natural resins differ rather greatly. GLASER (1926) claims that they are generally innocuous to the skin. Likewise BERING & ZITZKE (1935) mention that resins, possibly with

the exception of shellac, are insignificant from the standpoint of occupational hygiene. Nevertheless resin dust, like other dust, can cause acne formation (BLASCHKO). HERXHEIMER (1912) surmises that the fact of «mica» insulating substance causing dermatoses is due to its colophony and shellac content. BEINHAUER (1923) reports a case of dermatosis in a violonist caused by colophony. The skin tests showed a strong sensitivity to colophony but not to other resins. VEDROV (1938) reports that he has diagnosed acute dermatitis in polishers caused by inferior brands of shellac and turpentine. GOUGEROT & DESMONTS (1939) present a case of dermatosis caused by natural resin in a varnisher of handbags; who was able to go on with his work without a recurrence of the disease, which the authors suppose to be due to spontaneous desensitization. FLANDIN, RABEAU & UKRAINCZYK (1939) have presented a case of dermatosis due to varnish, which gave a positive reaction to tests with four kinds of resins.

BONNEVIE (1939), contrary to earlier opinions on the subject, asserts that the natural resins are among the most common causal agents in dermatoses springing from a basis of hypersensitivity. He describes some cases of dermatosis rising from resin, for instance, one caused by paint and varnish containing colophony. In two other cases the dermatoses had been caused by French polish, containing shellac; they gave a positive reaction to a skin test with both the shellac and the polishing compound made thereof. Most often, however, hypersensitivity to resin is found in connection with dermatoses due to adhesive tape, which contains different kinds of resins, e.g. colophony and dammar. The former substance is often used in its crude form dissolved in turpentine (i.e. balsam), wherefore the injurious effect of the pinches is added. Because of hypersensitivity to pinene and colophony BONNEVIE recommends for skin tests adhesive tape containing dammar and a synthetic substance similar to colophony (Lysaplast B adhesive tape) instead. The latter, according to him, brings about reactions in hardly anybody else but individuals hypersensitive to dammar. Mention has, in addition, been made of dermatoses caused by adhesive tape by SIEMENS, UNNA, GOUGEROT & BROUET and others, all of whom have noted dammar hypersensitivity in their cases and

by BLUMENTHAL & JAFFÉ as well as MAYER, who considers the dermatoses to have been caused by the unspecific irritation of turpentine, colophony or dammar.

Synthetic resins. The characteristic of synthetic resins to cause dermatoses is well known. Particularly in synthetic resin industry, where among others formaldehyde, hexamethylene-tetramine and phenol are used as raw materials, there is a great incidence of dermatoses. SCHWARTZ reports that in U.S.A. in the examination of 700 workers in the synthetic resin industry 7.5% in a year were found to have occupational dermatoses, while at the same time only 1.2% of all industrial workers suffered from these diseases. About 5% of all the cases of occupational dermatoses reported to the Ohio State Labor Commission for the year 1934 were among workers in the synthetic resin industry. According to SCHWARTZ 26 of a total of 30 workers in a urea formaldehyde resin factory during a period of one year suffered from dermatosis. Further, during eight months 27 out 400 workers at a bakelite factory had a dermatosis caused by their occupation. It is usually held to be due to the effect of formaldehyde, phenol or ammonia vapours (SACHS, KLEEBOERG, SPITZER, PERUTZ, SCHWARTZ etc.) and it localizes on the exposed skin, the face, neck, hands and arms. Symptoms of irritation of the eyes usually appear too. SACHS gives greater weight to the phenol vapours, whereas SCHWARTZ considers formaldehyde to be the causal factor in most cases. Thus in a certain factory, where the ventilation and safety equipments were not up to the mark, it was discovered that 10% of the workers had dermatoses, 80% of which had developed on the basis of formaldehyde hypersensitivity.

The finished products of phenol formaldehyde resins cause dermatoses notably more seldom. Theoretically there should not be any free formaldehyde or phenol in them, but the condensation process is not always complete, in which cases these substances may exist in a not united form in the products, thus injuring the skin more readily. In so far as the dermatitis develops it is considered to have been caused by formaldehyde hypersensitivity (MAYER, DOLGOFF, SCHWARTZ, BONNEVIE, PIRILÄ etc.). But BLUMENTHAL & JAFFÉ report that in the 7 cases of bakelite dermatitis discovered

by them they obtained a positive reaction to phenol, on the basis of which they concluded that phenol is the most common causal factor in this dermatosis. Wet work seems to have a progressive effect on the development of formaldehyde hypersensitivity arising from handling galalith and other formaldehyde condensations (WEDROFF & DOLGOFF, BONNEVIE).

KLEEBOERG (1922) reports a case, in which the vapours of a sealing-wax probably containing coumarone resin brought about several dermatosis attacks. Cold sealing-wax, on the contrary, had no harmful effects. SCHWARTZ too mentions cases of dermatosis caused by coumarone resin, in which the skin tests with this substance gave positive results. He also claims that phthalic anhydride and maleic anhydride can cause sensitization and that the latter is also a primary irritant. Further, BAADER, GLASER, KLAUDER and others have presented cases of dermatosis caused by synthetic resins. Acute dermatitis due to contact with garters, suspenders and wrist watch bands made of «elastiglass» (a derivative of vinyl resin) was described by ZEISLER, ZAKON and others). As the number of the synthetic resins is steadily increasing SCHWARTZ and others are of the opinion that, before a new product is put on the market, its injurious effects should be studied by means of tests on animals, and only those which prove to be free of irritating qualities should be taken into use.

Japanese and Chinese lacquers. PUSEY, WAYSON (1923), LITTLE (1924), WILLIAMS (1925), TOYAMA (1926) as well as TOYAMA together with USUBA (1926) have described dermatoses caused by Japanese and Chinese lacquers, which have been found even in individuals who have only come into contact with things coated with these lacquers (PUSEY, LITTLE etc.). According to TOYAMA the irritant factor is not resin but «urushiol», a dioxybenzene-derivative, which forms a greater part of the contents of Japanese lacquer than of the Chinese.

Drying oils. Cases of dermatosis caused by the drying oils used by painters are not many. In fact, SCHWARTZ states that the irritating effect of varnishes depends on the other ingredients (resins, solvents).

However, it has been found in oil factories that seeds of flax

and linseed oil cause dermatitis (VOKONN etc.). BREZINA made the observation that only the workers grinding flaxseeds got dermatoses, whereas the ones handling rapeseeds did not. ROCK & SALOZ (1921), WAZ (1924), BURCKHARDT & HELLERSTRÖM (1933) each have discovered one case of hypersensitivity to seeds of flax. The patient of the latter two, who in the beginning tolerated treatment with linseed cataplasma very well, acquired, within a period of two months hypersensitivity to linseeds which caused irritation of the skin; this was confirmed by skin tests. Moreover, BURCKHARDT & HELLERSTRÖM draw attention to a follicular and pustular dermatitis and formation of boils, which often appear when linseed poultice is applied. BOSTRÖM reports a reaction to linseed oil itself in a test on one painter suffering from eczema. Nevertheless allergy to pure linseed oil is, doubtless, very rare, since it is generally used as an ingredient of »pasta mollis», so popular in the treatment of dermatitis.

Pitch and Asphalt. It has been observed that coal-tar pitch and asphalt can cause in the workers handling them, a great deal of acne and papilloma formation (DOWNING etc.) and follicular hyperkeratoses, which may gradually develop into epitheliomas (e.g. LEYMAN 1907). BREZINA, LUTZ and others have described cases of dermatitis in workers with pitch. Further, the photosensitizing effect of pitch and asphalt is known, the skin thickens where it is exposed to sunlight and the injurious effect of these substances, and melanosis appears, the so-called »Pechhaut» (EHRMANN, OPPENHEIM, SCOLARI, FOERSTER & SCHWARTZ, BECKER & OBERMAYER etc.) The use of pitch and asphalt as binders in paints is, however, rather small. In fact, the literature does not seem to mention a single instance of dermatosis caused by these substances as ingredients of paints.

D. Organic solvents.

The question of the extent to which solvents act as causal factors in dermatoses on the basis of specific hypersensitivity or due to their toxic effect as primary irritants has not yet been given an exhaustive answer. Most investigators hold the most important

factor to be the property of the solvent to remove the protective fat of the skin, on which account the skin becomes more apt to be diseased owing to external factors. The observation, that many excellent fat solvents such as ketones, esters and ethers are relatively harmless to the skin, is in conflict with the foregoing conception. MAYER showed that the same individuals are often hypersensitive to several solvents resembling one another as to physical properties but entirely divergent as to chemical properties. Accordingly, he speaks of benzine-benzol hypersensitivity and physical group reactions. Further, MAYER and HOFFMANN discovered that the threshold value which causes a reaction on normal skin in tests made with aliphatic and aromatic hydrocarbons usually varies between 60 and 90%. This threshold value is often slightly lower, but only 10 to 20%, with individuals sensitive to benzine and benzol, and therefore he considers the reaction produced by the solvents in question toxic. Moreover, MAYER reports that he has never found aliphatic or aromatic hydrocarbons of small molecular weight to have caused allergic reactions. BERING & ZITZKE (1933) and BONNEVIE (1939), however, mention that they have obtained such a reaction in a few individual cases. The case seems to be different with respect to turpentine. PERUTZ (1926) reports that he succeeded by passive sensitization (PRAUSNITZ-KÜSTNER) to transfer allergy to turpentine into a normal individual as well as in desensitizing an individual allergic to turpentine by means of small doses of turpentine delivered per os. On this basis he is of the opinion that he has proved turpentine to be able to cause dermatoses on the basis of allergic hypersensitivity. The same conclusion has been drawn by many other investigators, for instance ROKSTAD & BONNEVIE (1941) in studying the effects of the different fractions of turpentine on the skin.

On the grounds of tests with organic solvents on normal skin, OETTEL (1936) divides their effects into two differing parts, i.e. an acute effect and an after-effect. The solvent having been in contact with the skin for a short time (1 to 30 min.), it causes subjective irritation symptoms (senses of warmth or cold, burning and itching) and erythema, which is soon followed by a reflex hyperemia, spreading over the neighbouring parts of the skin.

Moreover wheal is formed on the part where the action took place. After removal of the substance the symptoms disappear. However, if the action was strong enough, the erythema remains to a slight degree and forms a transition to the after-effect which sets in later, not until several hours after the action of the solvent. Then a second smaller wheal is formed taking on a yellow discoloration, to disappear again after some time. Later erythema and pigmentation develop on the same place. The manner of reactions obtained with the individual substances and groups of substances do not show any qualitative differences. The intensity of the effect, on the contrary, does differ considerably, on the basis of which OETTEL arranges the organic solvents in the following order: carbon disulphide, aliphatic hydrocarbons, alicyclic hydrocarbons, aromatic hydrocarbons, chlorinated hydrocarbons, ethers, alcohols, esters, ketones. In confirmation of the foregoing, it has been shown by experience that the hydrocarbons very often cause dermatoses. Whereas ethers and alcohols, which according to OETTEL produce no after-effects, as well as esters and ketones, which elicit no reactions at all in tests, are in general free of hazard to the skin.

Aliphatic hydrocarbons. According to PERUTZ aliphatic hydrocarbons can cause acute or chronic diffuse dermatitis and eczema most often on the hands and face, pustular or vesicular exanthema (petroleum scabies), follicular, circumscribed or diffuse hyperkeratosis, acne or comedone formation, increase of the pigment of the skin and diseases of the nails and of the oral cavity.

Dermatitis cases caused by benzine have been reported by VIGNOLO-LUTATI, ULLMANN, STAUFFER, MUNKWITZ, OLIN, KOEHLER etc. BONNEVIE claims that he obtained a positive eczema reaction with benzine in two cases. One of the patients was a chauffeur, who was not cured of his dermatosis until he had changed occupation, and the other was a hairdresser who had got the dermatitis when cleaning wigs with benzine. FLORET (1926) has presented a case resembling erysipelas in which the dermatitis later became necrotic. MERLE (1929) reported on a serious case of dermatitis caused by kerosene in a workingman while working in a tank. The dermatitis resembled a second degree burn. In addition, cases of dermatitis caused by kerosene are mentioned by BLASCHKO,

ULLMANN, PAGE, LEWIN, FELLNER, BONNEVIE, WOOD and others. BONNEVIE describes two cases in which the patients showed a strong positive reaction to the yellow kerosene they were handling but not to pure kerosene. ADAMS & IRBY (1935) report that they have got, seldom however, an allergic reaction to American crude petroleum, and WEDROFF & DOLGOFF (1935) with Russian naphtha. Among others, OPPENHEIM has presented acne, folliculitis and hyperkeratosis cases caused by contact with benzine. Corresponding cases of pathological changes in the skin caused by kerosene have been mentioned by ULLMANN, OPPENHEIM, BREZINA, KREN, BALBAN, PAUTRIER, FASAL, BOGDANOVIČ and others.

Sangajol has also been mentioned as a causal factor in dermatoses (BREZINA & TELEKY, HARNAPP, MAYER, v. SCHEURLLEN). MAYER holds its harmful effect to be due chiefly to the aliphatic hydrocarbon content. v. SCHEURLLEN considers benzol and its homologues the irritant factor. Benzol is soluble in water and therefore also in damp skin, its solubility being 0.073%. But according to v. SCHEURLLEN it is sufficient to cause a dermatosis after the solvent has removed the protective fat from the skin. In proportion to the relatively extensive use of sangajol the incidence of the dermatoses caused by it is not great.

Alicyclic hydrocarbons. Owing to the wide-spread use of turpentine in different occupations and domestic life and to its relatively great injurious effect on the skin, the literature dealing with skin diseases caused by turpentine is vast (TURNER, MCCORD, GLASER, BIRNBAUM, ZINSSER, AIELLO, LEHMANN, STAUFFER, MAZZETTI, ŠČERBAKOV, FLANDIN, RABEAU & UKRAINCZYK, BALBI, FEROND, SEEBERG etc.).

20% of the cases of eczema due to chemical irritation which were treated at the Dermatological Department at Zürich in 1936 were caused by turpentine. The number of cases due to any other causal agent was smaller. BONNEVIE (1939) reports that of the 1,285 cases of idiosyncratic eczema examined at Finsen Institute in Copenhagen 14% were hypersensitive to pinene. BERING & ZITZKE (1935) claim that turpentine is the most common causal agent in occupational diseases of painters, and SCHWARTZ (1939) mentions that 1% of all dermatoses owing to occupations are caused by

turpentine. SCHMIDT (1938), HOFBAUER (1941) and certain other investigators consider that surrogates of turpentine are causal agents in dermatoses just as often as turpentine itself.

PERUTZ (1926) divides turpentine dermatosis into an acute, subacute and chronic stage. He regards the acute stage as allergic and that, as the dermatosis becomes chronic, a gradual desensitization takes place. In its acute stage the dermatosis frequently spreads over a great area, whereas in the chronic stage it is usually limited to the regions which are directly effected by turpentine (FRIEBOES & SCHULZE). In the acute stage the symptoms may be very marked with the dermatosis spreading over the whole body and resembling scarlet fever (BLACKWOOD) or with a papular dermatosis invading a broad area (FEIBER). It is most common that the occupational dermatosis caused by turpentine manifests itself in a manner corresponding to the description given by PERUTZ of the subacute stage. Erythema, vesicles and itching in the skin of the hands and of the arms are symptoms. Frequently there is weeping too and now and then the dermatosis leaves behind it pigmentation and atrophy of the skin (SACHS). Chronic eczema may also cause changes in the nails (HELLER). KOELSCH, OPPENHEIM and others have described acne formation due to turpentine. Moreover, this solvent can cause urticaria (FRIEBOES). It has also been found that absorbed through the skin turpentine has caused general toxic symptoms. RIDDER has reported a case in which the patient had got kidney poisoning from external use of turpentine.

MOSER (1931) is of the opinion that turpentine in a pure form is harmless to the skin but when it has become oxidized or contains impurities it has an injurious effect. Moreover he holds that pine oil, unsaturated hydrocarbons, carbon tetrachloride etc. added to turpentine are more often the cause of dermatoses than turpentine itself. McCORD (1926) draws attention particularly to impurities contained by turpentine distilled from wood (formic acid, methyl alcohol, formaldehyde, phenol, pyridine, acrolein etc.) and supposes that the irritating effect of turpentine mentioned above is chiefly due to these.

PERUTZ (1926) emphasizes the importance of the unsaturated terpenes contained in turpentine on the basis of a positive 1- α -pinene

reaction in four patients hypersensitive to turpentine. Later investigations have confirmed that the terpenes are the chief agents in the etiology of turpentine dermatoses. DANBOLT & BURCKHARDT (1935) obtained a reaction also to α -pinene in all the cases in which the skin test was positive to balsam turpentine. The reactions corresponded to each other both in patients hypersensitive to turpentine (eczematous reaction) and in normal individuals (toxic reaction). The different terpenes of other turpentine fractions too elicit reactions, which shows that they too, and not only pinene, may be of significance as causes of dermatoses. Similarly BONNEVIE (1939) produced a positive pinene reaction in 60 of his 61 patients hypersensitive to turpentine. The only patient who did not give a positive reaction to pinene reacted to limonene and dammar too. In these tests BONNEVIE used both pinene and French balsam turpentine in a 50% solution in olive oil. On the basis of the results mentioned BONNEVIE holds it to be proved that practically speaking the pinene which forms about 90% of the contents of balsam turpentine is always an active causal agent in dermatoses due to this turpentine.

Several investigators have noted differences in the characteristics of different turpentine brands with respect to sensitization capacity and as causal factors in dermatoses. MCCORD (1926) reports that different kinds of turpentine distilled from wood are more injurious to the skin than balsam turpentine. BURCKHARDT & SCHAAF (1937) drew the same final conclusion on the grounds of their investigations. Moreover they express the opinion that the harmful effect of turpentine increases on oxidation. BURCKHARDT's (1938) experiments on animals pointed in the same direction. In confirmation of the foregoing WEDROFF (1932) obtained in five of his cases as strong a reaction with 1% Russian turpentine (using his drop test method) as with 50% Merck's purified German turpentine. BOSTRÖM reported that by patch tests on 20 painters Swedish turpentine produced 15 positive reactions and French balsam turpentine only 7. RUNDBERG (1937) obtained positive reactions to turpentine in 24 painters suffering from eczema; 20 of them reacted to sulphate turpentine, 18 to kiln turpentine and 13 to balsam turpentine. Correspondingly HELLERSTRÖM

(1939) on performing skin tests on 80 individuals with 10% sulphate, kiln and balsam turpentine obtained positive reactions in 9, 9 and 7 cases respectively. When studying the sensitivity of the skin to the monocyclic terpenes, α -pinene, β -pinene and Δ_3 -carene, HELLERSTRÖM elicited the strongest reactions with the last mentioned. Since there is rather much Δ_3 -carene in sulphate turpentine (35%) and in kiln turpentine (20—30%) and hardly any in balsam turpentine, HELLERSTRÖM explains the stronger effect of the first two to depend in general upon Δ_3 -carene specifically. ROKSTAD & BONNEVIE (1941) and ROKSTAD (1946) have mainly studied the effects of different fractions of turpentine on normal and hypersensitive skin using ROKSTAD's adhesion chamber method. The turpentine fractions employed in the tests were α -pinene, β -pinene, Δ_3 -carene, limonene, »monocyclic terpenes» and »impurities having a low boiling point», the latter were distilled from sulphate turpentine. The tests made with varying concentrations showed that the different terpenes had approximately as strong a toxic effect on the skin, whereas the »impurities» had a considerably weaker effect. In contrast to the similarity of the toxic effects of the various terpenes, their sensitization capacities distinctly differed. In confirmation of HELLERSTRÖM's investigations ROKSTAD & BONNEVIE elicited stronger eczematous reactions to Δ_3 -carene than to α -pinene and β -pinene. ROKSTAD arranges the fractions in question in the following order according to their sensitizing capacities: Δ_3 -carene, limonene, β -pinene, α -pinene, »monocyclic terpenes», »impurities of sulphate turpentine of low boiling point». Thus the results of the experimental research made in recent years corroborate the observation made earlier, that turpentine distilled from wood irritate the skin more and cause dermatoses more often than balsam turpentine.

Aromatic hydrocarbons cause the same kind of skin conditions as aliphatic hydrocarbons despite the fact that these solvents entirely differ from one another chemically. According to KOELSCH benzol and its homologues effect the skin chiefly because of their property of dissolving the fat out of it. Further he reports that he has found symmetric erythema on the limbs, which he thinks is probably due to the harmful effect of benzol on the sympathetic

centres of the spinal chord. Workers in the rubber industry who dissolve rubber in benzol have dermatitis with cracking and dryness of the skin on the hands, but these symptoms may, however, be due to other reasons too, for instance rubber, resins, turpentine, aniline etc. (KOELSCH, MILIAN). BERING & ZITZKE have presented among their cases of dermatosis one, in which benzol and turpentine tests produced a positive reaction with a latent period of three days. Although very few reports have been given of positive eczematous reactions produced by benzol, dermatosis caused by it is not considered rare. In addition to the investigators already mentioned also MEDA, LANDE & KALINOWSKY, TOEGEL, SCHWARTZ, WENZEL, RIEDEL and others have reported cases.

The homologues of benzol have an effect on the skin resembling that of benzol (KOELSCH, STOCKÉ etc.). SEEBERG presented a case in which there was simultaneously hypersensitivity to cymene, Swedish turpentine and caoutchouc. GALEWSKY, HOFBAUER and others have diagnosed cases of dermatosis caused by tetralin (tetrahydronaphthalene).

Chlorinated hydrocarbons. Chloroform, carbon tetrachloride and other chlorinated hydrocarbons of low boiling point rather seldom cause dermatoses. This depends partly on the fact that because of their general poisonous properties they are relatively little used as technical solvents. KOCHMANN, RASCH, BONNEVIE, OETTEL and others have presented cases. LAPIDUS (1929) demonstrated the harmful effect of these solvents on the skin by experiments on animals.

Trichlorethylene and other chlorinated hydrocarbons of higher boiling point are used in the same way as other usual technical solvents and they come into close contact with the skin in the same way, thus causing dermatoses (STÜBER, TOTTIE etc.). STÜBER (1931) found 31 cases of dermatosis (Dermatitis, Eczema) among 284 patients who had a trichlorethylene poisoning; 13 of them were acute and 18 chronic. In the former cases the symptoms were rubor and burning and in the more severe cases the eruption was vesicular. The symptoms of the chronic type did not differ from those of common eczema.

Alcohols. Ethyl alcohol and higher alcohols are in general rela-

tively innocuous to the skin (FRIEBOES & SCHULZE etc.). According to FASAL ethyl alcohol as such never causes eczema, but only when it is denatured with methyl alcohol, pyridine, turpentine etc.

Among others MUMFORD (1925) and BERING & ZITZKE (1935) have presented cases of dermatosis caused by methyl alcohol in physicians and nurses. BREZINA, KOELSCH and others have found in polishers cases of eczema caused by alcohol denatured by methyl alcohol or pyridine. SCHREINER, TELEKY and others have also reported cases of dermatosis caused by pyridine.

Ethers, ketones and esters used as such in patch tests do not cause any irritation in normal skin. In general they have not been found to have caused dermatoses. Thus MAYER recommends the use of amylbutyrate ester in patch tests as an indifferent solvent for lipoid-soluble test substances. BEINTKER (1928), however, has reported a case of hypersensitivity to ethyl acetate, and ENGELHARDT (1934) another in which hypersensitivity to ethyl, amyl and butyl acetates was manifested.

E. Cleansing.

The harmful effects of washing and cleansing are to be seen in almost all occupations. KLAUDER (1943) reported that 16% of his 527 cases of occupational dermatoses were due to detergents. This percentage includes also the cases of skin diseases caused by the organic solvents used in cleansing the hands.

Due to the effect of water the skin particularly on the palms of the hands swells and the protective fat is removed, and consequently the skin gets dry and cracks. The powders, sand, sawdust etc. used in washing damage the skin mechanically, thus adding to the effect of water. In this way a simple chronic dermatitis arises primarily, in connection with which a secondary hypersensitivity to some substance dealt with at work develops (LOMHOLT and others).

KOEHLER (1942) holds that the harmful effect of mild soap solutions depends on the alkali freed from the soap as it hydrolyzes. Owing to this hydrolytic effect the epidermis of the skin swells and denaturing phenomena take place in its cells. Moreover, alkali

removes the fat from the skin forming soaps with the fatty acids. And finally the skin loses its normal acid reaction, which is considered to protect it against bacteria and above all against the injurious effect of the alkali coming from outside. In general the opinion prevails that soap in itself does not cause hypersensitivity as its additional ingredients may do (LOMHOLT, HANSEN, BONNEVIE and others). ROSTENBERG and SULZBERGER (1937) have got positive reactions with soap in about $\frac{1}{3}$ of their cases in the contact dermatitis and atopic dermatitis groups, but not a single one in non-eczematous patients. They do not, however, consider these reactions to be signs of specific hypersensitivity to soap but suppose them to be due to the considerable greater sensitivity of the individuals of the first-mentioned groups to the harmful effect of alkali.

BURCKHARDT (1935 and 1938) studied the capacity of the skin to neutralize alkali by means of a method developed by him and SCHAAF. He observed that this capacity varied greatly in healthy individuals. But neutralization took place slowly in almost all individuals suffering from alkali eczema. BURCKHARDT considers that the skin neutralizes alkali on the basis of a special active function, during which the CO_2 given out by the skin probably acts as the neutralizer. According to him a weak capacity of the skin to neutralize alkali is not a result of alkali eczema but vice-versa. In fact this quality remains even after the dermatosis is cured. Further, BURCKHARDT experimented with the effect of alkali on the sensitization of the skin of animals to pinene and human beings to nickel. The experiments showed that a preliminary treatment with alkali facilitates the development of hypersensitivity. JORDAN, DOLCE & OSBORNE (1940) demonstrated that alkaline soap had the same effect.

OPPENHEIM (1915) paid particular attention to both the corrosions caused by lye solutions and changes in the nails of laundresses. The distal end of the nail becomes loosened from the nail bed and since the loosening takes place first in the centre, the lateral parts remaining undamaged longer, the nail loosens from the nail bed in the shape of a halfmoon. The cause of these nail changes is considered to be washing with hot soda and soap solutions (OPPENHEIM, WOLF).

The chloride of lime and sodium hypochlorite earlier so abundantly used in aniline factories in cleansing the hands were very often found to have caused irritation of the skin. Through the effect of these substances the function of the perspiratory glands increases and hyperhidrosis develops (LEYMANN, BACHFELD etc.). When the use of these substances is given up the symptoms disappear quickly. Among others, RABEAU and UKRAINCZYK (1939) drew attention to the irritating property of cleansing solutions containing chromates.

Because of the above-mentioned harmful effects of the different cleansing materials efforts have been made to develop new detergents lacking these disadvantageous properties. In 1934 SCHULTZE & PRIOR presented a product as a result of their experiments, which they called Praecutan, containing sodium salts of sulphuric acid esters of fatty acids of great molecular weight and the condensations of the latter (KOEHLER). In contrast to soaps, no alkali separates from this product and its acidity (ca. pH 6) is close to the isoelectric point of the skin. Similar acid or neutral detergents have been presented by others too (DIETEL, KÖTZING, KLAUDER, GROSS & BROWN and others). In spite of the good points of these detergents the problem of cleansing the hands has not even yet been satisfactorily solved. In many cases, for instance with painters, the cleansing effect of these substances is not sufficient, wherefore it is necessary to continue the use of other substances, for instance organic solvents, in cleaning the hands (KOEHLER).

IV. Aim of the Study.

The aim of this study was to find an answer on a clinical and experimental basis to the following questions in particular:

1. What is the incidence of occupational diseases of the skin among the workers of paint factories and painters in Finland?
2. What kind of skin changes occur?
3. What are the most significant causal factors in the dermatoses?
4. To what extent is the development of the dermatoses based on allergy?

5. Has the allergy to the occupational substances been present previously or did it develop owing to occupation?
6. To what extent have the dermatoses caused disability?
7. Are various constitutional factors of significance in the course of the occupational dermatoses?

PART 2

Personal Investigations.

I. Material and Methods Employed.

A. Material.

The aim of this study was to find out about the occurrence of occupational dermatoses in the workers of paint factories and in painters. Since the arranging of a reliable study of all the workers of these occupations in Finland would have been impossible, the material was limited to include the following groups (Table 4, p. 61): 1. The employees of the three biggest paint factories, comprising a total of 378 persons, which is ca. 95% of all the workers in this line in Finland. 2. The workers of the only white lead factory amounting to a total of 24 men, who are exposed to lead and white lead. 3. The workers of 50 painter's firms and painting workshops, as well as of 12 spray painting workshops, at Helsinki and Tampere, totalling 601 painters, 83 spray painters and 56 painter's assistants (washers). The total number of the persons working in the said factories and painting workshops included in the material amounts to 1,142. 4. In addition the material includes all the workers in these occupations as well as the polishers and varnishers who came to the Dermatological Department of Helsinki University Hospital because of an occupational disease while this investigation was being made (April 1945 to February 1947).

As far as possible the author himself personally interrogated the workers of groups 1. to 3. to find out if they had earlier had dermatoses which might have been caused by their occupations and at the same time inspected their skin in view of the dermatosis

..... 19..... No...../.....
 Name:..... Referred by
 Date of Birth..... Occupation (nature of work).....
 Address: Tel.....
 Employer Insurance Company.....
 Diagnosis:

I. Family History:

1. Presence of dermatoses in the family:

 Are there any allergic diseases in the family (urticaria, asthma, hay fever,
 migraine, angioneurotic edema)?

II. Personal History:

2. Previous medical conditions:.....

 3. Allergic diseases:

4. *Dermatoses:*

Milk-crust: Other skin eruptions:

5. How long have you been in the present a) occupation, b) firm?
 a)..... b).....

Other occupations:
 Substances and technic employed at work (their effects):.....

 At home (washing, washing powders etc.):.....

6. Protective measures (gloves, ointments):
 Cleansing of hands (detergents, how often):.....

7. First occurrence of dermatosis similar to the present one, its course:.....

8. Present dermatosis:.....

9. What other physician has given treatment (diagnosis, date)?.....
10. Patient's idea of cause:.....
11. Absence from work, avoidance of substance involved, vacations (their effects):
12. Other troubles possibly due to occupation:.....
13. Treatment (also prior to present dermatosis):.....
14. Have the following factors an effect on the dermatosis (in chronic cases)?
Seasons, sun, climate, change of surroundings, steambath and other washing,
medicines, food (fish, eggs, milk, meat, cheese, spices, coffee, chocolate, berries,
alcohol), dust, domestic animals, plants, coloured clothes, furs, other diseases,
over-exertion, menstruation, pregnancy:
15. Recent illnesses (cold in the nose, toothaches etc.). Their possible effects
on the dermatosis:
- Further remarks:

III. Present Condition:

17. General physical examination:
18. *Skin*:
Seborrhea, acne, scaliness: Complexion:.....
Freckles, pigmentation:Sweating, moisture of skin:.....
.....Dermographism: Forehead:Arm:
Photographs: Patch tests:
19. Local symptoms:

in progress. In some cases the factory physician performed this preliminary examination alongside of his regular work, and sometimes the master painter assisted in making the interrogations, when it could not be managed otherwise owing to the remoteness of the working place or to other difficulties.

The workers who were found on the basis of these preliminary examinations to have had dermatosis at some previous date or who were just then suffering from it were subjected to special examination. In all cases suspected of possibly being occupational dermatosis a systematic examination was performed according to the procedure presented below.

B. Methods.

1. Clinical Examination.

Each patient was investigated according to a case report form drawn up by the author for the study of occupational dermatoses in particular, in view of achieving the greatest possible exactitude and uniformity in evaluation of the information which was available (pp. 47—48). Moreover laboratory tests, such as blood count, sedimentation test, gastric analysis and examination of urine and stool, were performed on a great number of the patients.

The questions pertaining to the presence of dermatoses in the family or earlier occurrence in the patient (1.—4.) were made to ascertain the patient's predisposition to these. Quite mild illnesses in the patient himself, of which no clear conception could be formed, were not taken into consideration, for instance, temporary »hives» and dermatitis of some two days duration. Correspondingly only dermatoses of long duration in the patient's family (1.) were considered because the information given is usually vague and confused, wherefore no definite conclusions can be drawn. The results are given in Table 30. The purpose of questions 13.—15. and the one pertaining to work at home (5.) is to disclose the possible existence of causes not dependent upon occupation. For the verification of mycosis all cases clinically suspect were examined microscopically and a culture on SABOURAUD's proof medium was performed in some.

Recent medical conditions at the onset and during the course of the dermatosis (15.) were noted, in order to find out to what extent focal infections were involved. Some authors (URBACH, TARRAS-WAHLBERG and others) have particularly emphasized the significance of foci of infection (in teeth, tonsils, paranasal sinuses and elsewhere) in maintaining eczema. However, their effect need comparatively seldom be taken into consideration in occupational dermatosis, in which external factors play the decisive role. KOCH (1940), in fact, reports that foci of infection in general have hardly any effect on the course of occupational dermatosis and therefore it is not necessary to look for them except in some particular cases. For this reason no such examinations as, for instance, roentgenographic investigation of the teeth, examinations of the paranasal sinuses etc. have been made. As the course of the dermatosis in the cases examined in general was consistent with the causative external irritant, and as the clinical examination did not, in this material, distinctly indicate any connection between the course of the skin diseases and the foci of infection, the symptoms pointing to these (diseases of the teeth were chiefly involved) are not given special attention in presenting the case reports.

Some investigators hold that different constitutional types of skin (e.g. seborrhea) promote the development of occupational dermatosis. Point 18. pertains to this. The results are dealt with in Table 30.

Although every case was systematically investigated according to the same form, the author chiefly included the reports of those cases with respect to which it was necessary to give a thorough explanation of the course of the dermatosis, as well as of those which are referred to in the following text. As the cases of dermatitis artificialis in general resemble each other considerably, only some typical case histories are presented here. In reference to the latter only such information is in general given which was of essential significance in diagnosing.

2. Patch Tests.

a. Technic.

For discovering specific hypersensitivity of the skin the well-known patch tests of JADASSOHN-BLOCH were performed. The technic briefly stated is as follows (the same as BONNEVIE's 1939). The suspected substance (moistened or in salve) is placed on the skin or, if it is in a liquid form, a bit of blotting paper or linen, 7 mm square, saturated with it is used. The test is covered with a piece of cellophane etc. to prevent evaporation and held down by adhesive tape.

As far as possible adhesive tape with a minimum of irritating properties was chosen in order to avoid irritation. Above all it was considered important that the adhesive tape did not contain terpenes, which is due to the fact that previous investigations on the occupations in question have showed the frequent incidence of hypersensitivity to turpentine. At the commencement of the study, owing to the shortage caused by the war, there was not a great choice of adhesive tapes and the ones available were of varying qualities. Later »Lysaplast» (Nordisk Plaster Industri, Copenhagen) and »Poroplast» (Lohmann K. G., Fahr a. Rhein) were used exclusively. If the adhesive tape irritated the skin either another kind was used or some other means was employed to fasten the test substance, e.g. zinc oxide and gelatine bandage.

In general the tests were removed after the lapse of twenty-four hours, whereat the results were examined for the first time. In some cases the tests remained on the skin for 2 or 3 days, because the patients were prevented from coming earlier.

b. Selection of Test Substances.

The test substances were selected with two chief aims in view. The patch test should indicate the presence of hypersensitivity 1. to substances used in the occupation, 2. to those involved outside the occupation.

Routine tests. BONNEVIE's (1939) routine tests were chiefly used to discover hypersensitivity which had developed outside the occupation. The technic being the same as BONNEVIE's, his

series was adopted almost without any alterations. Pinene (50%) only was replaced by sulphate and kiln turpentine mixture in 50% dilution (= aa 25% in oil). This was done because in Finland the use of balsam turpentine is very insignificant in comparison to that of the latter kinds. When the author later found several cases, not included in this investigation, in which hypersensitivity to thioprene or thicol had developed (it is being printed for *Acta Dermato-venereologica*) this substance was added to the routine tests (Table 1).

Table 1.

Routine Tests

Abbreviations: alc. = alcohol 70%, aq. = aqueous, lan. = lanolin, o.o. = olive oil, petr. = petrolatum.

Name of Substance	Dilution (%)	Vehicle
Turpentine (sulphate, kiln t. aa)	50	o.o.
Primula (a recent leaf of <i>Pr.obconica</i>)	as is	—
Wood tar (pine, juniper, birch, beech t. aa) ..	100	—
Mercuric chloride	0.1	aq.
Colophony	33	o.o.
Balsam of Peru	25	lan.
Potassium bichromate	0.5	aq.
Nickel sulphate	5	aq.
Coal tar	100	—
Formaldehyde	4	aq.
Pyrogallol	5	lan.
Soft soap	50	petr.
Quinine hydrochloride	1	aq.
Silver nitrate	2	aq.
Chrysarobin-anthrarobin aa	2	petr.
Salicylic acid	5	lan.
Iodine	0.5	alc.
«Persil» (moistened)	—	aq.
Para-amidophenol	2	lan.
Paraphenylenediamine	2	lan.
Resorcin	5	aq.
Thicol ¹	50	aq.

¹ Employed in only some cases (see above).

Painters' tests. The author has come to the conclusion on the basis of the studies of other investigators that the best way of arriving at an etiologic diagnosis is to make skin tests with the substances used by the patients themselves in their work. This, however, can only be done at an acute stage of the dermatosis for later it is seldom possible to procure the substances to which the patient was exposed at the onset. But when this study was planned it was already evident that many cases of dermatosis which had begun years, perhaps decades earlier would come under investigation, and that only a part of the cases would be so fresh that the substance in question would be available. Therefore, to fill this gap in the systematic examination, a number of substances, the so-called painters' tests, were introduced. In the selection emphasis was put chiefly on those ingredients of paints which according to previous investigations have caused dermatosis on the basis of hypersensitivity. In addition, it was considered necessary to include numerous other coating materials which are used so commonly in Finland that it called for an investigation of their primarily irritating or sensitizing characteristics. Further, a number of aniline dyes, which are used mainly in the dyeing of textiles, were included because the workers of our paint factories must handle them too, wherefore they have to be taken into consideration as causal agents of dermatoses in these workers. The test series in its entirety was also done on the painters for it was a suitable way of obtaining control material for comparison.

If the test substance was soluble in a vehicle non-irritant to the skin, it was dissolved in this for the test. Liquids were applied to the skin as such or diluted with oil (olive oil or castor oil). In choosing a form suitable to the patch tests for solid, insoluble substances, preliminary tests were performed on 10 normal persons as follows: The substance was applied on the skin: 1. as a dry powder, 2. moistened with water, 3. mixed with oil (in equal parts). Since irritation was not produced on healthy skin by any of these, the third alternative was chosen because it was the most practicable (the test substances remain homogeneous when mixed, and it is easy to get about the same amount for the test).

The concentrations of the test substances were determined to

Table 2.

Painters' Tests.

Abbreviations: alc. = alcohol 70%, aq. = aqueous, acet. = acetone, chl. = chloroform, e.a. = ethyl acetate, lan. = lanolin, m.e.k. = methyl ethyl ketone, o.o. = olive oil, sat. = saturated.

Name of Substance	Dilution (%)	Vehicle	Name of Substance	Dilution (%)	Vehicle
Solvents, Vehicles etc.					
Benzine	60	o.o.	Colophony	sat.	chl.
Sangajol	60	o.o.	Manilla copal	sat.	alc.
Kerosene	60	o.o.	Dammar	sat.	chl.
Benzol	100	—	Shellac	sat.	alc.
Toluene	100	—	Durophen	sat.	chl.
Xylene	80	o.o.	Albertol	sat.	e.a.
Cymene	80	o.o.	Alkyd resin	sat.	e.a.
Solvent naphtha	80	o.o.	Phthalic anhydride	sat.	m.e.k.
Tetralin	50	o.o.	Cellulose nitrate ..	sat.	acet.
Decalin	60	o.o.	Wood tar pitch ..	sat.	chl.
Trichlorethylene	50	o.o.	Coal tar pitch	sat.	chl.
Methyl alcohol	100	—	Pyridine	30	o.o.
Acetone	100	—	Litharge	50	o.o.
Methyl ethyl ketone ..	100	—	Cobalt chloride	10	aq.
Boiled linseed oil	100	—	Cresol	1	aq.
Tall oil	100	—	Phenol	2	aq.
Rape seed oil	100	—	Chloride of lime ..	2	aq.
Mustard oil	100	—	Potass. hydroxide ..	0.5	aq.
China wood oil	100	—	Arsenic trioxide ..	5	lan.
Inorganic Pigments					
Lithopone	50	o.o.	Cadmium red	50	o.o.
Zinc yellow	50	o.o.	Cinnabar	50	o.o.
Cadmium yellow	50	o.o.	Mercuric oxide ..	50	o.o.
Ultramarine blue	50	o.o.	Umber brown	50	o.o.
Copper suboxide	50	o.o.	Red oxide of iron ..	50	o.o.
Titanium dioxide	50	o.o.	Paris blue	50	o.o.
Ilmenite black	50	o.o.	Chrome green	50	o.o.
White lead	50	o.o.	Cobalt blue	50	o.o.
Red lead	50	o.o.	Lamp black	50	o.o.
Chrome yellow	50	o.o.	Paris green	50	o.o.
Chromium oxide	50	o.o.	Antimony oxide ..	50	o.o.
Organic Dyes and Pigments					
Aniline	25	lan.	Sudan yellow	sat.	aq.
Alkaline blue	sat.	aq.	Sudan black	sat.	aq.
Auramine	sat.	alc.	Sudan orange	sat.	aq.
Fuchsin	sat.	alc.	Sudan red	sat.	aq.
Methyl violet	sat.	alc.	Sudan brown	sat.	aq.
Rhodamine	sat.	alc.	Sudan blue	sat.	alc.
Spirit orange	sat.	alc.	Toluidinetoner	50	o.o.
Victoria blue	sat.	alc.	Green P.L.X.	sat.	aq.
Anthosine	sat.	aq.	Helio fast blue ..	sat.	aq.
Bismarck brown	sat.	alc.	Monastral blue	sat.	aq.
Congo brown	sat.	aq.	Nigrosine	sat.	aq.
Congo blue	sat.	aq.	Brilliant spirit black	sat.	alc.
Chrysoidine	sat.	alc.	Wool orange	sat.	aq.
Lake yellow	50	o.o.	Sulphon. acid brown	sat.	aq.
Metanil yellow	sat.	e.a.	Sambesi black	sat.	aq.
Parared	50	o.o.	Lake black	50	o.o.
Ponceau	sat.	aq.			

correspond as nearly as possible to the threshold value of irritation, i.e. just below the concentration irritating normal skin, in order that also presence of mild hypersensitivity would be brought forth. For this purpose preliminary tests with various concentrations were done on 10 control persons, 5 of whom had eczema. The substances which did not irritate the skin at all were employed as follows: soluble substances as saturated solutions, insoluble substances mixed with oil (in equal parts), and the liquid substances as such (100%).

The composition of the painters' tests is presented in Table 2.

The series comprises three groups.

1. Solvents, vehicles etc.
2. Inorganic pigments.
3. Organic dyes and pigments.

Chamber tests. In performing skin tests with volatile substances (solvents) cellophane does not satisfactorily prevent evaporation. Particularly when performing the test on a person at work the covering preventing evaporation may loosen to such an extent that the result is not fully dependable. Thus in doing a test with high concentrations of a solvent a distinct toxic reaction may be elicited, but nevertheless when it is renewed next to the site of the previous test the reaction may be negative owing at least partly to the fact that the test substance evaporated more rapidly in the latter case than in the former. In order to lessen the inaccuracy due to evaporation the skin test was made in a great number of cases with some of the solvents by employing the «adhesion chamber method» of ROKSTAD (1939). The author modified the chamber itself slightly in that 0.2 mm thick celluloid plate was used instead of the original 0.3 mm one. In this way the ceiling of the chamber could be made level and unnecessary air space removed (Fig. 1). In the chamber the volatile solvent is better retained than in the ordinary patch test covered by a cellophane layer. Besides, when the skin absorbs the test substance it swells over an area corresponding to the chamber and forms a wheal. If it is not formed, it is due to the fact that the celluloid plate was not pressed against the skin tightly enough, and the test must be renewed. Thus the

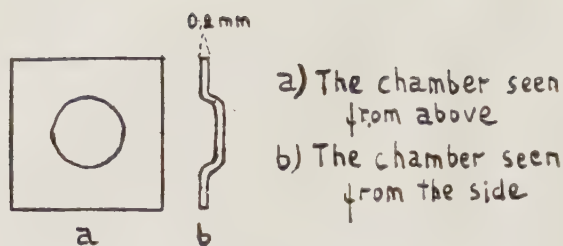


Fig. 1.

success of a test when using the chamber method can be observed (ROKSTAD). Chambers were employed in doing tests with benzine, sangajol, kerosene, turpentine and fraction of sulphate turpentine with a boiling point of $172\text{--}180^\circ\text{C}$ (the term turpentine fraction 172° is used).¹ This series is called standard chamber tests (Table 3).

Table 3.

Standard Chamber Tests

Abbreviations: o.o. = olive oil.

Name of Substance	Dilution (%)	Vehicle
Benzine	60	o.o.
Sangajol	50	o.o.
Kerosene.....	50	o.o.
Turpentine (sulphate, kiln t. aa)	50	o.o.
Turpentine fraction B.P. $172\text{--}180^\circ\text{C}$	30	o.o.

Turpentine fraction 172° was taken because the terpenes it contains (carene, limonene, dipentene) have been demonstrated by previous literature to have a stronger sensitization capacity than fractions with a lower boiling point, e.g. pinene, and because it has been surmised that sulphate and kiln turpentines cause dermatosis, owing particularly to the fractions with a high boiling point, more frequently than balsam turpentine (see p. 40).

¹ I wish to express my gratitude to J. GRIPENBERG, D.Tech., who performed the necessary distillations.

c. Site of Tests.

In order to avoid errors due to variation of hypersensitivity possibly present in different regions of the skin, the skin tests were done as far as possible at the same site on all patients. The sequence was as follows:



Fig. 2. An allergic reaction, grade + + +, erythema, infiltration and vesiculation. (ca. 1:2).

Routine tests: right forearm and upper arm.

Organic dyes and pigments: left forearm and upper arm.

Solvents, vehicles etc.: right thigh.

Inorganic pigments: left thigh.

Chamber tests: left thigh.

Any deviation is mentioned in the case report.

In cases where localized hypersensitivity to a certain substance was suspected, a negative test was renewed, when possible, near the dermatosis or at its site after recovery.

d. Interpretation of Reactions.

The skin tests were left on the skin for from 1 to 3 days. The reactions were read for the first time when they were removed, in most cases after a lapse of 24 hours. The reading was repeated

on the third or the fourth day and about a week subsequent to the application of the skin tests.

The reactions were classified as allergic or eczematous reactions and toxic reactions.

A reaction was considered *allergic* only when its field distinctly exceeded the size of the patch (7 mm) and when it persisted for about a week or more (Fig. 2). In general the reaction appeared from 1 to 3 days after the patch was applied and strengthened on the first days (short latent period). If the reactions appeared on the

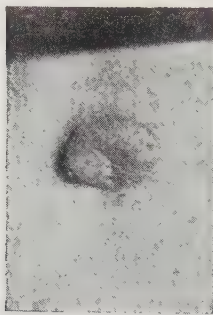


Fig. 3. A toxic reaction, grade IV, single, large, confluent bulla. (ca. 1:1).

fourth or fifth day or later (long latent period), it was held to be an indication of sensitization caused by the test. The strengths of the reactions were designated in the following way:

- + = distinct, persistent erythema.
- ++ = erythema and infiltration.
- +++ = the former and vesiculation.
- ++++ = serous bulla.

The *toxic reaction* was in general strongest when the test was removed from the skin, whereafter it weakened rapidly (Fig. 3). The strengths of the reactions were designated as follows:

- I = rapidly disappearing erythema.
- II = erythema and temporary swelling.
- III = the former and pustules.
- IV = purulent bulla.

The allergic reaction with a short latent period was regarded as decisive. It was held to indicate hypersensitivity which the patient had had prior to the performance of the test. If the patient was known to be exposed, at the onset of the dermatosis or some days earlier, to the substance eliciting an eczematous reaction, it was regarded as the causal agent. Whereas allergic reactions with a long latent period were not given any diagnostic significance.

In general only those toxic reactions which were produced by the chamber tests were taken into consideration (see p. 55). In concordance with the majority of other investigators the author is of the opinion that a positive toxic reaction probably indicates the weakness of the resistance of the skin to the toxic effect of solvents, but that it is of no significance in constituting the specific cause of the dermatosis. It must however be noted that the distinction between a weak allergic and toxic reaction is vague. Therefore in some cases the reactions recorded as toxic may have been an indication of a weak specific hypersensitivity to the substance in question.

3. *Diagnosis.*

The diagnosis of *eczema allergicum*¹ was given to a dermatosis, usually of long duration, if specific hypersensitivity to some substance was observed. But persistent, slowly abating skin changes characteristic of chronic inflammation (see p. 72) developed in many other cases too, despite the fact that specific hypersensitivity could not be proved (see p. 72). They were termed *eczema chronicum*. The other inflammatory skin changes generally of shorter duration and evidently caused by toxic irritation were called *dermatitis artificialis*.² If specific hypersensitivity was found, the substance or substances involved were noted in the case reports in parentheses after the diagnosis. If there was only a previous occurrence of the dermatosis, its date was noted in the same way.

It is generally known that patch tests produce positive reactions in only a fraction of occupational dermatoses, only about 18%

¹ In the literature the terms, contact dermatitis (allergic), *eczema idiosyncraticum*, *eczema venenata* etc. are used.

² Also termed contact dermatitis (toxic), *dermatitis venenata*, *dermatitis toxica* etc.

of which are of an allergic origin according to SCHWARTZ, and the diagnosis must in most cases be made on the basis of other facts. In conformance with other investigators the author has based his diagnoses chiefly on the typical course and symptoms of the disease. Stress was mainly laid on the following facts (corresponding to criteria set forth by the American Medical Association's Committee on Occupational Dermatoses, 1939):

1. The person has been working in contact with an agent known to have produced similar changes in the skin.

2. The time relationship between exposure to the agent and the onset of the dermatosis is correct for that particular agent and that particular abnormality of the skin.

3. The site of the onset of the cutaneous disease and the site of maximum involvement are consistent with the site of maximum exposure.

4. The lesions present are consistent with these known to have followed the reputed exposure or trauma.

5. So far as the examiner can ascertain, there has been no exposure outside of occupation that can be implicated.

6. If the diagnosis is dermatitis, the following items are important:

Attacks after exposure to an agent, followed by improvement and clearing after cessation of exposure, constitute most convincing evidence of the occupational factor as cause.

The results of the patch tests.

II. Results of the Investigations.

A. *Incidence of Occupational Dermatoses in Various Occupations.*

1. *General Survey.*

The main part of the investigation comprised a total of 1,142 employees of paint factories and painting workshops and firms. Of these 120 were found either to have had a previous dermatosis or to be just suffering from a dermatosis the course, type and localization of which lead to suspect occupation as the cause. On

the basis of thorough examination 103 cases (case 1—57 and 59—104) were diagnosed as occupational or to have been essentially exacerbated by the occupation. Table 4 gives the distribution of

Table 4.

Research in Paint Factories and Painting Shops							Miscellaneous Cases	Total Number of Occupational Dermatoses Cases
	Number of workers	Incidence of occupational dermatoses						
		Total		1. 6. 1945—31.5. 1946		Other date		
		Number	% ¹	Number	% ¹			
Employees of paint factories	378	57	15.1±1.8	29	7.7±1.4	28	1	58
Paint workers	177	35	19.8±3.0	19	10.7±2.3	16	—	35
Washers, charwomen ..	30	20	66.7±8.6	9	30 ±8.4	11	1	21
Outdoor workers, office employees etc.	171	2	1.2±0.8	1	0.6±0.5	1	—	2
Workers of white lead factory	24	—	—	—	—	—	—	—
Painters	601	39	6.5±1.0	22	3.7±0.8	17	6	45
Spray painters	83	3	3.6±2.0	2	2.4±1.7	1	—	3
Painter's assistants	56	4	7.1±3.2	2	3.6±2.5	2	—	4
Polishers	—	—	—	—	—	—	5	5
Varnishers	—	—	—	—	—	—	4	4
Total	1 142	103	9.0±0.8	55	4.8±0.6	48	16	119

the cases in the several occupations. Within a year (June 1, 1945 to May 31, 1946) a total of 55 persons were found to have dermatosis, whereas the remaining 48 had had it earlier or acquired it later. When 16 patients (case 58 and 105—119) arrived for treatment from other working places, the total number of verified cases of occupational dermatosis rose to 119. Table 5 presents the cases comprised by the material. It reveals at what work the dermatosis had developed and to what substances hypersensitivity was verified, in so far as sensitization had taken place. Reports of a part of the cases and necessary explanatory notes are to be found on pp. 112—154.

¹ The standard errors are calculated using the tables of Ritala (1934).

Table 5.
Survey of Cases.

The case histories printed are designated with*.

Case No	Sex	Nature of Work at Onset of Dermatosis	Specific Hypersensitivity
<i>Paint Factory Employees</i>			
1. Paint Factory Workers			
1*	♂	Purifying of turpentine	Turpentine
2*	♂	Handling of turpentine	Turpentine
3*	♂	Varnish cooking	Turpentine
4*	♂	Paint grinding, washing with turpentine	Turpentine
5	♂	Painting	Turpentine
6*	♀	Cooking of floor wax, washing with turpentine	Turpentine
7*	♀	Filling of aniline dye cans and bags	Bismarck brown, wood tar (treatment)
8*	♀	Filling of paint cans	Turpentine, flare-up of eruption
9*	♀	Cooking of floor wax	Turpentine
10	♂	Paint mixing	
11*	♂	Precipitating of pigments	
12*	♂	Printing of wallpapers	
13*	♀	Filling of paint cans	
14*	♀	» » » »	
15	♂	Paint mixing	
16	♂	» »	
17	♂	Paint grinding	
18	♂	Varnish cooking	
19	♂	Boiling of linseed oil	
20	♂	Paint mixing	
21	♀	» »	
22*	♂	» »	
23	♂	» »	
24	♂	» »	
25	♂	Painting	
26	♀	Filling of paint cans	
27	♀	» » » »	
28*	♀	Making of washable wallpapers	
29	♀	» » » »	
30	♂	Mixing of colour pastes	
31	♀	Filling of paint cans	
32	♀	Filling of paint cans, washing with turpentine	
33	♀	Filling of paint cans	
34	♀	» » » »	
35	♀	» » » »	
2. Office Employees			
36*	♀	Expedition of paints, washing with turpentine	Turpentine
37*	♂	Handling of turpentine	

Case N:o	Sex	Nature of Work at Onset of Dermatosis	Specific Hypersensitivity
3. Washers and Charwomen			
38*	+	Polishing with floor wax	Turpentine, primula
39*	+	Washing	Turpentine
40*	+	Polishing with floor wax, washing with turpentine	Turpentine, tar (treatment)
41*	+	Washing	Turpentine
42	+	»	
43*	+	»	
44	+	»	
45	+	»	
46	+	»	
47*	+	»	
48	+	»	
49	+	»	
50	+	»	
51	+	»	
52	+	»	
53	+	»	
54	+	»	
55	+	»	
56	+	»	
57	+	»	
58* ¹	+	Washing of floor wax cans	Turpentine
<i>Painters</i>			
59*	O ₃	Painting	Turpentine, chromium
60*	O ₃	»	Turpentine, local, wood tar (treatment)
61*	O ₃	»	Turpentine, Bismarck brown, flare-up of eruption
62	O ₃	»	Turpentine
63	O ₃	Whitewashing, painting	Turpentine, local
64*	O ₃	Tarring	Wood tar
65*	O ₃	Painting	Turpentine
66*	O ₃	Varnishing	Phenol formaldehyde resin, wood tar
67	O ₃	Painting	Turpentine
68*	O ₃	»	Turpentine
69	+	»	Turpentine
70*	O ₃	»	Formaldehyde
71*	O ₃	»	Balsam of Peru (treatment)
72*	O ₃	»	Wood tar (treatment)
73*	O ₃	»	Mercury (treatment)
74*	O ₃	»	
75	O ₃	»	
76	O ₃	Painting, washing with turpentine	
77	O ₃	Painting	
78	O ₃	»	

¹ This case belongs to »miscellaneous cases».

Case No	Sex	Nature of Work at Onset of Dermatoses	Specific Hypersensitivity
79*		Whitewashing	
80	♀	Painting	
81		»	
82		»	
83		»	
84*		»	
85		»	
86		»	
87		»	
88		Painting, washing with benzine	
89		Painting	
90		»	
91		»	
92		»	
93		»	
94		»	
95*		»	
96		»	
97	♀	Polishing, painting	
<i>Spray Painters</i>			
98*	♀	Spray painting	Phenol formaldehyde resin, flare-up of eruption
99	♂	Spray painting, washing with turpentine	
100	♂	Spray painting, washing with turpentine	
<i>Painter's Assistants</i>			
101*	♀	Washing	Turpentine
102	♀	»	
103	♀	»	
104	♀	»	
<i>Miscellaneous Cases</i>			
105*	♂	Painting	Turpentine, flare-up of eruption
106*	♂	»	Chromium, mercury (treatment)
107*	♀	»	Cobalt
108	♂	Painting, washing with naphtha	
109	♂	Painting, washing with turpentine	
110	♂	Painting	
111*	♀	Polishing	Shellac, colophony, flare-up of eruption
112	♀	»	Turpentine, wood tar (treatment) flare-up of eruption
113	♂	»	
114	♂	Polishing, washing with lye	
115*	♀	Polishing	
116*	♀	Varnishing	
117*	♀	»	
118*	♀	»	
119	♀	»	

2. Employees of Paint Factories.

The paint factories of Finland are chiefly occupied with varnish cooking and mixing and grinding paints from pigments and other ingredients. In addition small amounts of pigments are manufactured from raw materials. The workers may be classified in three groups according to the quality of their work.

1. Paint workers, who chiefly deal with paint materials. This group comprises various kinds of workers, such as paint mixers, paint grinders, varnish makers, fillers of paint cans, painters etc. They, however, all have one thing in common, that is, exposure to pigments, solvents and ready-made paints. Their hands get stained, and, in addition to soap and water, solvents must be frequently used for cleansing. As a matter of fact, in different departments diverse substances are used. For instance in an oil paint department it is difficult for a worker to avoid handling turpentine, whereas in a wallpaper or cellulose lacquer department it is used only to a small extent or not at all, unless the worker washes his hands with it. The differences are, however, slight, and besides since the workers have to change work temporarily due to cases of illness and vacations, it was deemed better to present the paint workers in one group.

2. Washers and charwomen. The chief task of the washers of the paint factories is cleaning paint cans and vessels. Their skin is almost constantly exposed to different cleansing materials, turpentine, thinner, kerosene and lye solutions etc. The work of the paint factory charwomen differs from ordinary cleaning in that they must handle solvents to a greater extent, for instance, turpentine, and, further, they must at times do the work of the washers mentioned.

3. Outdoor workers and office employees, who either never or only temporarily come in contact with paint materials. This group includes all those not belonging to the former ones.

In surveying Table 4 we may observe that 57 (15.1%) of the total number of employees of the paint factories, 378 persons, either had had occupational dermatosis prior to this investigation or had it just then. A correct picture of the incidence of dermatoses in paint

factories can only be got by comparing the different groups to each other (Table 4 and 7). We notice that 20 workers acquired dermatosis while doing washing or cleaning. This is 66.7% of the persons permanently doing this work. As, however, a part of the patients were only temporarily employed as washers when they fell ill, the proportional number of cases in this group was slightly increased, wherefore the said percentage is not entirely comparable to the corresponding ones in the other groups. Nevertheless, it clearly indicates that in the paint factories the incidence of dermatoses in the washers was considerably greater than that in the other workers. Namely, there were only 35 cases among the 177 paint workers (19.8%) and 2 among the other 171 employees (1.2%).

In order to get an idea of how great a proportion of employees in the paint industry in Finland suffer yearly from occupational dermatosis, we may further refer to Table 4. During a year (June 1, 1945 to May 31, 1946) 19 paint workers (10.7%), 9 washers (30%) and 1 of the other employees (0.6%) had dermatosis. These figures include all the cases in which skin symptoms were found during the said period (in a mild form in some at that time).

These figures distinctly manifest that there is a considerably greater incidence of dermatosis in the washers than in the paint workers and that the outdoor workers and office employees very seldom suffer from occupational dermatosis. Correspondingly Table 19, p. 86, discloses that the washers acquire dermatosis already about 2 years on an average from the date of commencing their work, whereas the other workers fall ill after an average of 7 years at work in their occupation.

Evidently women are more predisposed to dermatosis than men (Table 6 and 7). When taking all groups into consideration, 23.3% of the women but only 9.1% of the men had acquired occupational dermatosis. These figures are not, however, entirely comparable, because the washer's occupation adds to the number of dermatoses particularly in women. But a distinct difference is to be noted between men and women also when surveying the group of paint workers. Only 15.4% of the men had had occupational dermatosis, whereas the corresponding figure with the women is 29.6%. The same conclusion may also be drawn from Table 19, which shows

Table 6.

	♂ + ♀		♂		♀	
	Number of workers	Incidence of dermatoses	Number of workers	Incidence of dermatoses	Number of workers	Incidence of dermatoses
Paint workers ..	177	35=19.8%	123	19=15.4%	54	16=29.6%
Washers, char-women	30	20=66.7%	2	—	28	20=71.4%
Outdoor workers, office employees etc.	171	2= 1.2%	94	1= 1.1%	77	1= 1.3%
Total	378	57=15.1%	219	20= 9.1%	159	37=23.3%

Table 7.

Incidence of Dermatoses among Men and Women
at Paint Factories

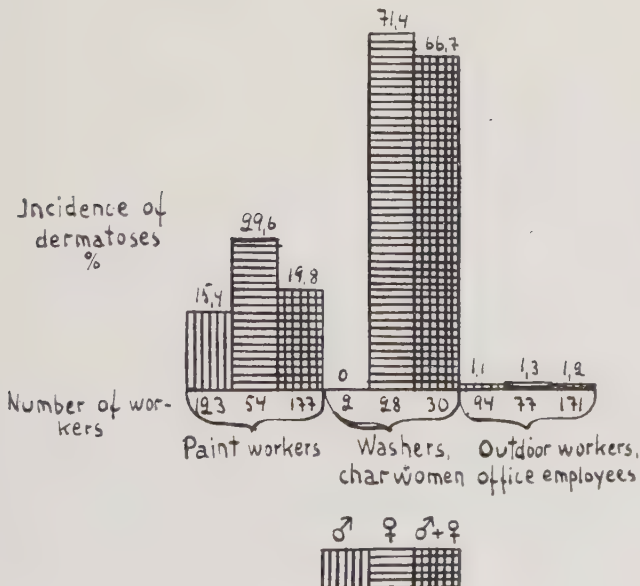
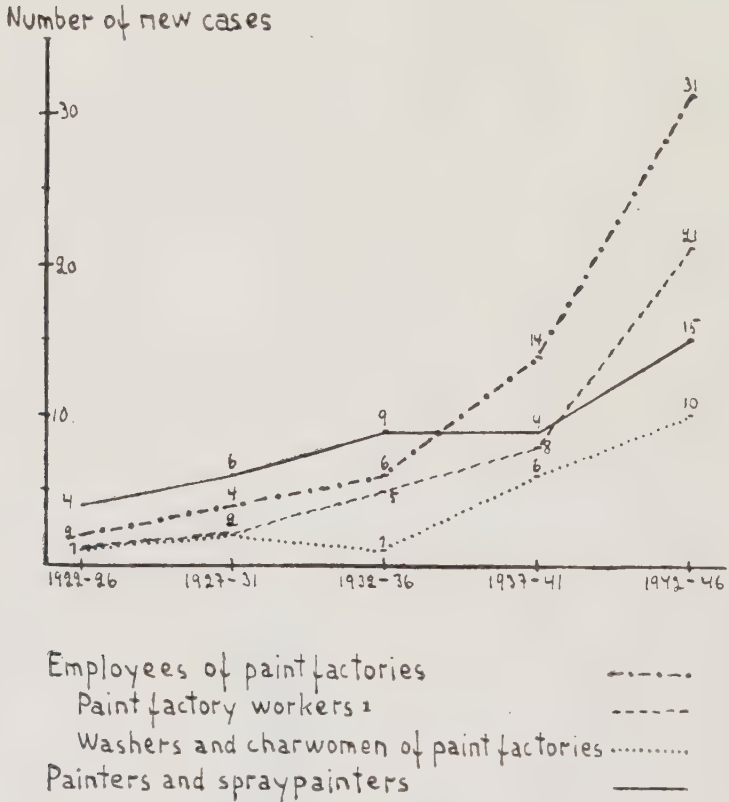


Table 8.
Incidence of New Cases during Five-Year Periods.



that female paint factory workers¹ got dermatosis 5 years on an average after they had begun work whereas the men got it after 8 years.

The great significance of organic solvents as causal agents in dermatoses is indicated by the great incidence of cases in the washers, who must use them in great abundance in their work.

Table 8 shows that over a half of the cases of occupational dermatosis in workers of the paint factories developed after 1942. The difference is so considerable that it may not be regarded as due to the slight increase in the number of workers during this time.

¹ See p. 74, group 1.

Moreover the workers did not in general leave the factory immediately upon getting the dermatosis but were placed at some other work when necessary, wherefore this fact does not explain the previous, relatively small numbers either. The increase of dermatoses during the said time is also disclosed by a certain plant physician's statistics, according to which in 1937—1941 he discovered seven new cases and in 1942—1946 fifteen new ones. The reason for this increase must be held to be the considerably greater use of sulphate and kiln turpentine in Finland during the war, which attained its height during 1942 and 1943, when it was necessary to use it almost entirely instead of some other solvents which had been employed in abundance earlier (sangajol, balsam turpentine etc.). The fact that the increase with respect to the washers was not so considerable was due to the majority of them already earlier having acquired dermatosis. The notable increase of dermatoses as a result of the introduction of Finnish turpentine clearly shows their great significance as causal agents in the paint factories.

A rather great incidence of occupational dermatoses was found in this material as compared with corresponding research in other countries. SCHWARTZ & TULIPAN (1939) reported that 7% of the workers in dye and chemical industries annually acquired dermatosis due to their occupation, whereas the corresponding figure in this material was 10.7% of the paint workers. But it must be taken into consideration that a relatively great proportion of these workers were women, who evidently are more predisposed to dermatosis. However, in dye and paint mixing plants, which probably are nearest to the Finnish paint factories in nature, the incidence of dermatosis is considerably smaller according to the previous literature (p. 23). It is possible that in the said mixing plants solvents are used less than in the paint factories of this country. Nevertheless for the main part the difference is doubtless temporary and depends upon the increased use of Finnish turpentine during recent years. The relative abundance of cases of dermatosis in washers corresponds to previous experiences with respect to the strongly irritating effect of washing on the skin (p. 42).

3. *Workers at the White Lead Factory.*

The only white lead plant in Finland has been running since 1929. In 1934 a lead smelting plant was founded in connection with it. There are 24 workers who come in contact with lead or its salts. They are divided among the several departments as follows:

Lead smelting plant.....	16 men
Lead storehouse	2 men
White lead department	6 men
Total	24 men

The workers at the storehouse handle only pure lead or scrap lead. In the smelting plant the workers are in addition exposed to lead vapours, wherefore they use protective masks. At the white lead department there are three men doing precipitation, in which they use lead salt solutions. Three other men pack the white lead into barrels. By using masks they protect their respiratory organs against lead dust, but their skin is exposed to it. At the end of the workday the workers bathe and change their clothes.

During the whole seventeen-year period that the factory has been functioning not a single case of dermatosis which could have been suspected of having been caused by the occupation was discovered. This observation is in concord with the conception to be found in the recent literature, that lead does not in general cause hypersensitivity.

4. *Painters and Spray Painters.*

The incidence of dermatoses in painters was considerably smaller than in the workers of paint factories (Table 4). Of a total of 601 painters 39 (6.5%) had had occupational dermatosis. During a period of a year (June 1, 1945 to May 31, 1946) only 22 painters or 3.7% were found to have dermatosis, whereas the percentage for paint workers at the same time was 10.7%. The dermatosis broke out in the painters after they had practiced their occupation for

already 16 years on an average but with the paint factory workers the corresponding time was 7 years (Table 19). The increase of incidence, during the war, of dermatoses in the painters was not as marked as among the said workers. This is probably due to the fact that the painters can be more careful in the handling of turpentine, and they are, as a matter of fact, for they are well aware of the injurious effect of turpentine.

The painters were men for the great part, wherefore comparison between men and women does not give a reliable result. However, it can be noted (Table 19) that also in the painter's and polisher's occupations the cases of dermatosis in this material began much sooner in women after their beginning work (an average of 9 years) than in men (an average of 18 years).

83 spray painters were studied. Three of them (3.6%) had had occupational dermatosis. The material is too small for comparison. But since two of the patients had evidently acquired dermatosis when temporarily in contact with turpentine, whereas cellulose lacquers and spirit varnishes (spray painting) had not irritated the skin, only 1 case may be considered actually due to spray painting. Thus the observations made point to the fact that spray painting causes less dermatoses than ordinary painting work.

The painter's assistants, the washers (56), show an incidence of 7.1%, that is 4 persons. This number is considerably smaller than that of the washers at the paint factories (66.7%). As a matter of fact, the painter's assistants' work is partly only ordinary cleaning, and solvents are used to a considerably smaller extent.

Exactly corresponding material for comparison is not available to any great extent in the literature, but information published in America regarding incidence of occupational dermatoses in general and particularly in painters (see. p. 24) seems to indicate that it is approximately the same as in Finland. RUNDBERG reports in 1937 that in Sweden as high a percentage as 25% of the painters were discovered to suffer from occupational dermatosis.

B. Clinical and Experimental Study.

1. Symptoms.

Occupational dermatosis is characterized by the fact that it is due to the effect of an external, injurious agent. Therefore its commonest manifestation is dermatitis or eczema, which occur either on the basis of toxic irritation or allergic hypersensitivity. The symptoms of an acute stage are erythema and swelling in milder cases and in addition vesiculation, weeping and crusting in more severe ones. In connection with these scaliness appears and pruritus is regularly to be observed as a subjective symptom. In chronic form the skin thickens, lichenifies, loses its elasticity, becomes fissured and may be hyperpigmented. Other skin conditions (nail changes, melanosis etc.) are considerably less frequently involved than dermatitis and eczema as occupational diseases particularly in the occupations now in question.

Symptoms of acute or chronic skin inflammation were present in the majority of the cases of this material. A little over a half of them (chiefly diagnosed as dermatitis artificialis) were of relatively short duration and the skin changes corresponded to the above mentioned symptoms of an acute phase. Whereas in the majority of the cases of allergic eczema and in a number of other cases too (eczema chronicum) symptoms of chronic skin inflammation (lichenification, fissures, etc.) were, in addition, manifested. Secondary infection had frequently aggravated the condition especially in a chronic phase, pustules, crusts and sometimes symptoms of lymphangitis and lymphadenitis appearing. Further, there was one case in which nail changes appeared as the only symptoms (case 11).

2. Specific Hypersensitivity.

The classification of the cases into allergic and toxic ones is to be seen in Table 9. All the cases in which an allergic reaction was produced were included in the former group; they amount to 37 or 31.1% of the whole material. In reality the number of allergic dermatoses may be greater for it is not certain whether positive

Table 9.

	Total Number of Cases	Allergic Cases					Toxic Cases	
		Allergy to occupational substances		Allergy only to other substances	Total			
		Number	%		Number	%	Number	%
Employees of paint factories	58	15	25.9	—	15	25.9	43	74.1
Paint workers ..	35	9	25.7	—	9	25.7	26	74.3
Washers, charwomen	21	5	23.8	—	5	23.8	16	76.2
Outdoor workers, office employees etc.	2	1	50	—	1	50	1	50
Painters	45	14	31.1	4	18	40	27	60
Spray painters	3	1	33.3	—	1	33.3	2	66.7
Painter's assistants	4	1	25	—	1	25	3	75
Polishers	5	2	40	—	2	40	3	60
Varnishers	4	—	—	—	—	—	4	100
Total	119	33	27.7±4.1	4	37	31.1±4.2	82	68.9±4.2

reactions have been elicited in all the allergic cases by means of the test methods employed. Hypersensitivity may have been merely local, and it is impossible to perform patch tests with all the substances in question at the site of a cured dermatosis. Further, in cases of a previous dermatosis tests could not be done with the substances to which the patient was exposed at its onset, wherefore it was not certain that the causal agent was always included in the tests. By means of the tests the injurious effects of a given occupation cannot be entirely imitated and they may therefore be negative particularly in cases where the allergy is of a mild nature. Besides, it is possible that hypersensitivity present during a previous dermatosis may have disappeared later.

There were 27.7% or 33 cases of hypersensitivity to substances used occupationally; in two of them it was only local. According to SCHWARTZ ca. 18% of occupational dermatoses are of an allergic

Table 10.

	Total Number of Cases	Allergic Cases					Toxic Cases	
		Allergy to occupational substances		Allergy only to other substances	Total			
		Number	%		Number	%	Number	%
Paint factory workers	37	10	27.0	—	10	27.0	27	73.0
Painters, polishers..	53	17	32.2	4	21	39.6	32	60.4
Washers, charwomen	25	6	24	—	6	24	19	76
Varnishers	4	—	—	—	—	—	4	100
Total	119	33	27.7±4.1	4	37	31.1±4.2	82	68.9±4.2

origin. The greater incidence of allergic cases in this material is undoubtedly due to the fact that turpentine, which is a strongly sensitizing substance, is used in especially great abundance in the occupations dealt with. In three cases hypersensitivity was verified only to substances used therapeutically, and in case 70 the cause of the hypersensitivity to formaldehyde could not be determined with certainty. However, it is probable that the patient had earlier been in contact with formaldehyde in his work, for instance as an impurity contained in turpentine.

The number of dermatoses in the different groups are so small that absolutely reliable comparison with respect to the incidence of allergic dermatoses in them cannot be made. Therefore the occupations are classified as four greater groups according to the nature of the work (Table 10):

1. Paint factory workers = paint workers + outdoor workers and office employees etc.
2. Painters and polishers. This group also includes the spray painters.
3. Washers and charwomen.
4. Varnishers, whose work differs so considerably from that of the foregoing workers that it gives reason to distinguish them from the others by including them in a separate group.

This classification is also used in subsequent tables.

Though the differences between these groups are not great (Table 10), it seems that in the occupations less frequently causing dermatoses the number of cases developing on the basis of allergy is greater than in those occupations where dermatosis is more common. Thus 32.2% of the painters and polishers suffering from it were hypersensitive to substances used at work, whereas the corresponding number as to paint factory workers is 27% and 24% with respect to washers and charwomen.

3. Causes of the Dermatoses.

a. Actual Causes.

Allergic cases. In general the causal agent of an eczema owing to specific hypersensitivity can be ascertained by means of epicutaneous tests. Table 5 reveals the presence of hypersensitivity to occupational substances in this material as follows:

Turpentine	26 cases		
Bismarck brown	2 »	}	In one the eczema was chiefly due to hypersensitivity to turpentine
Chromium	2 »		
Phenol formaldehyde resin	2 »		
Wood tar	2 »		In one the eczema was due to hypersensitivity to phenol formaldehyde resin.
Shellac	1 case	}	In the same case Cobalt siccativ.
Colophony	1 »		
Cobalt	1 »		

The case histories and their interpretation disclose what role allergy plays. In many of the cases the toxic dermatitis appeared primarily, promoting the development of allergy. The persistence of the dermatosis must be considered in most cases to have been due to the fact that sensitization had already occurred.

In addition therapeutically employed substances caused sensitization in 8 cases, as follows:

Wood tar	5 cases
Mercury	2 »
Balsam of Peru	1 case

In three cases hypersensitivity was ascertained only to these substances and not those used occupationally. In them the treatment for toxic dermatitis caused the sensitization. In the 5 remaining cases hypersensitivity to substances occupationally employed was simultaneously present (evidently primarily).

Toxic Cases. Skin tests are not of special value in discovering the etiology of toxic dermatitis (p. 59). Table 11 reveals that toxic

Table 11.

Substances Used in Standard Chamber Tests	Number of Cases with Positive Toxic Reaction ($\geq$ I):	
	in 64 cases of the material ¹	in 22 control individuals ²
Mixture of sulphate and kiln turpentine 50% ..	10	4
Turpentine fraction 172° C, 30%	23	8
Benzine, sangajol, kerosene, 60%	11 ³	8 ³

reactions to the different solvents were produced in approximately the same proportion of toxic cases in this material as in those of other kinds of eczema or dermatitis in which contact with the said solvents was not ascertained. This shows that the reactions elicited were not of a specific nature.

The fact that among the washers, who handle solvents to the greatest extent, the incidence of dermatoses was considerably greater than in the other occupational groups investigated gives strong evidence that the solvents were the chief causal factor in the dermatoses verified. Lye, which only a small part of the washers

¹ Cases with specific hypersensitivity to turpentine have not been included.

² Eczema and dermatitis cases, in which the patients were not exposed to turpentine or other solvents to any notable extent.

³ The total number of reactions to benzine, sangajol or kerosene.

and very few of the other patients had handled, seems to be of smaller significance in these cases.

The fact that the increase of dermatosis cases coincided with the increased use of Finnish turpentine (see p. 69) indicates the great significance of this solvent as a causal agent. Moreover, the case reports disclose that in a great part of the cases turpentine was the most probable causal factor. Often it was not due to the work itself that the skin was irritated but to cleansing the hands with turpentine.

The results produced by the chamber tests show that the turpentine fraction 172° (terpenes with a high boiling point) irritates the skin in 30% concentration in more cases than a sulphate and kiln turpentine mixture of 50% strength. It is evident that the irritating properties of Finnish turpentines are due to their high boiling fractions. They contain a considerably greater amount of these fractions than balsam turpentine. Further, results of the chamber tests imply that the Finnish turpentines probably have a somewhat more intensely irritative effect on the skin than aliphatic hydrocarbons. Aromatic hydrocarbons were used in 80—100% strength in skin tests without noteworthy reactions. Ethers, esters and ketones did not irritate the skin at all even when they were applied in 100% concentration. On the basis of the foregoing the solvents contained in the paints most commonly used in Finland may be rated as follows with respect to their irritating property: sulphate and kiln turpentine, aliphatic hydrocarbons, aromatic hydrocarbons, alcohols, esters, ethers and ketones.

Contrary to the effect of many solvents, inorganic pigments, organic dyes and pigments, oils, resins or other binders did not in general bring about toxic irritation, though they were used in the tests either in pure form, mixed with oil in equal parts or as saturated solutions. Moreover, this investigation did not in general indicate that these substances alone had a primarily irritating effect without the aid of washing, rubbing or other injurious factors. In 3 cases (116—118) suspicion that the toxic dermatitis was caused by vapours of a synthetic resin was strongly justified. Also white-wash was sometimes the cause of dermatosis, though it was used in a comparative small measure.

The extremely great role played by turpentine as a causal agent in dermatosis in this material corresponds to its abundant use in Finland during the war and to previous conceptions with regard to its noxious effect on the skin. Already in 1913 SACHS drew attention to this property of turpentine, and later investigations have proved that it is the most common cause of hypersensitivity (see p. 37). Moreover, several investigators (see pp. 38—40) have demonstrated that various kinds of turpentine produced from wood have a strongly irritating effect. Whereas, in the literature (BERING & ZITZKE etc.) it has been showed that other coating materials cause dermatosis much less frequently.

b. Predisposing Effect of Other Skin Diseases and Injuries.

As to the predisposing effect of other skin conditions there are varying opinions. Many investigators hold that skin traumas are of great significance in this respect. In four cases of this material the dermatosis was due to the effect of injury (Table 12). In three

Table 12.

	Predisposing Factor		
	Injury	Fungi	Other dermatoses ¹
Allergic cases.....	1	—	—
Toxic cases	3	—	—
Total	4	—	—

cases of toxic dermatosis an occupational wound or abrasion was the primary cause. In the fourth case the patient first burnt himself slightly, whereafter the eczema developed on the basis of hypersensitivity to turpentine (case 3), which was probably promoted by the lowering of the resistance of the skin due to trauma.

Fungi were not found in a single case. For instance, the American literature (SCHWARTZ and others) has emphasized the significance of mycosis as a predisposing factor or a complication in occupational dermatoses. Evidently these diseases are so rare in Finland that their significance in this respect is comparatively small. When

¹ Dermatitis and eczema excluded.

investigating the incidence of fungi diseases in Finland during 1940—45 (a total of 92 cases) PÄTIÄLÄ discovered fungus dermatosis (epidermophytia) in only one painter, and it was present only in one of his feet and not at all in his hands, wherefore it was not suspected to have developed on the basis of occupational dermatosis.

But in numerous cases secondary bacterial infection had exacerbated the disease. This is natural, when the common incidence in Finland, especially during the war and following it (HÄGGBLAD), of bacterial dermatoses, particularly of secondary impetiginization, is taken into consideration. It is clear that skin suffering from chronic occupational dermatosis is exceptionally disposed to secondary infection, which in certain cases may retard recovery.

Dermatitis or eczema due to other factors occurred in the anamnesis of only 7 patients. However, in only a part of them the occupational dermatosis developed immediately after the nonoccupational one or shortly subsequent to its healing. In the remaining cases the predisposing effect of these dermatoses cannot be taken into consideration. Neither could it be found that the patients had suffered from other skin diseases which could have aided the development of the occupational dermatosis (see p. 97).

c. Prevention.

Preventive activity has not been taken up for study in connection with this work, for investigations would have had to be carried out during a considerably longer period, the effects of occupational hygienic measures not being revealed in one or two years. But the author's research gives several indications of what could be done to decrease the incidence of occupational dermatosis in the given occupations.

It is evident that as the use of Finnish turpentine, which in recent years has considerably raised the incidence of occupational dermatosis, can gradually be lessened, now that the war is over a notable improvement in this respect is to be expected. For the time being, however, due to difficulties in the foreign exchange situation it has been compulsory to continue to use it in great

abundance and to restrict the use of less irritating hydrocarbons and other imported solvents to the most necessary purposes.

Personal precaution, which possibly can be increased by advisory activity, would in many cases prevent the development of dermatosis. In the present, to a rather great extent mechanized industry the workers, in so far as they endeavour, can in many cases avoid contact with injurious substances. Before all it is imperative that solvents, particularly turpentine, are not used for cleansing the hands except in the most necessary cases, when no other means of doing it are available. As soon as it is possible, an effort should be made to introduce detergents non-irritating to the skin (see p. 44). In addition protective ointments and in some cases gloves could be used.

In some cases the patients themselves unintentionally prolong the course of the disease by using unsuitable treatment on their own initiative. If they immediately upon onset of even the mildest symptoms consulted a physician, the dermatosis could often be cured before it has become so exacerbated that they must take leave from work. By revealing allergy in process of development directly at the onset of dermatosis by means of skin tests, hypersensitive individuals can be transferred in good time to work which they can tolerate, and the dermatosis has not time to become severe. In addition, by means of advisory activity with respect to selection of occupation the number of persons unsuitable to given occupations because of their predisposition to eczema can be lessened. In inspecting new workers the plant physician can give advice as to what work each individual should be given to do.

4. Site of the Dermatoses.

a. Initial Site.

Occupational dermatosis breaks out on the area of the skin coming into direct contact with an injurious factor. This is so typical that it is considered one of the most important criteria in diagnosing occupational dermatoses (p. 60). Table 13 shows that in this material the dermatosis began in 95.8% of the cases either

Table 13.

	Total Number of Cases	Initial Site				
		Hands	Arms	Face, neck	Lower ex- tremities	Trunk
Paint factory workers	37	33	4	—	—	—
Painters, polishers ..	53	50	1	2	—	—
Washers, charwomen	25	24	1	—	—	—
Varnishers	4	1	—	3	—	—
Total number	119	108	6	5	—	—
%		90.8%	5.0%	4.2%	—	—

on the hands or the arms. In five cases (4.2%) the skin symptoms first appeared on the face. This starting point is natural particularly in cases 84 and 116—118, in which the dermatosis was caused by turpentine and varnish vapours. Obviously, the skin of the face was most sensitive to this irritation, to which extensive areas of the skin were exposed. In case 95 the patient had probably carried paint or turpentine to his face with his hands with irritative effects. It is also possible that in the beginning the dermatosis appeared on the face due to other causes and later it was exacerbated and maintained by painting work (the dermatosis appeared on the hands and arms).

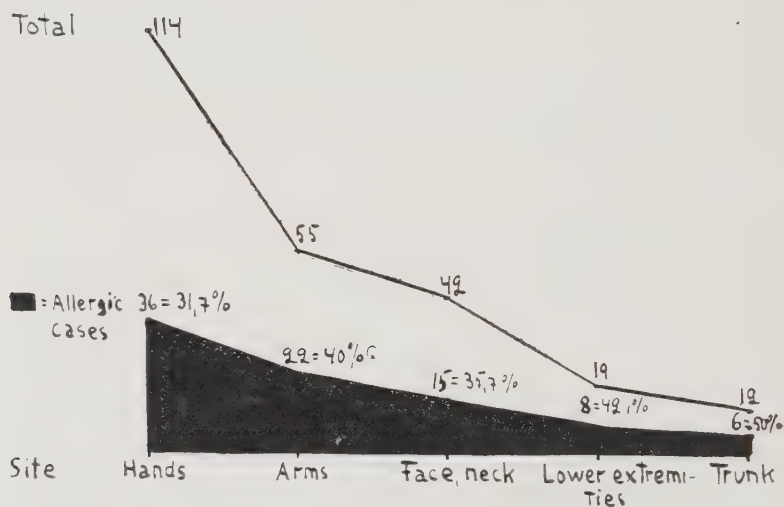
b. Later Localization.

Occupational dermatosis is also mainly restricted to areas exposed to irritation. Thus it chiefly, often exclusively, appears on the hands. In 114 cases (95.8%) of this material there were symptoms on the hands (Table 14). There was dermatosis on the arms as well as on the face and neck, in numerous cases (48.2% and 35.3%), whereas the number of cases in which it appeared on areas protected by clothes was considerably smaller (lower extremities 15.9% and trunk 10.1%). The site of the dermatosis on the hands was in general the dorsum or the fingers, whereas in only 10.1% of the cases the more resistant skin of the palms of the hands became diseased. However, it must be noted that polishers are predisposed, due to the nature of their work, to getting dermatosis on the palms.

Table 14.¹

	Total Number of Cases	Regional Localization				
		Hands	Arms	Face, neck	Lower extremities	Trunk
Paint factory workers	37 (10)	36 (10)	18 (4)	15 (4)	7 (1)	4 (—)
Painters, polishers	53 (21)	52 (20)	19 (14)	17 (8)	9 (6)	7 (5)
Washers, charwomen	25 (6)	24 (6)	16 (4)	7 (3)	3 (1)	1 (1)
Varnishers	4 (—)	2 (—)	2 (—)	3 (—)	—	—
Total number ..	119 (37)	114 (36)	55 (22)	42 (15)	19 (8)	12 (6)
%		95.8 (97.3)	48.2 (59.5)	35.3 (40.5)	15.9 (21.6)	10.1 (16.2)

Table 15.

Regional Localization. Allergic² and Toxic Cases.

¹ The number of cases with hypersensitivity to occupational or other substances is given in parentheses.

² To occupational or other substances.

Thus three of the five polishers in this material had dermatosis at this site. When surveying Table 15 we observe that allergic eczemas are more apt to spread to areas of the skin which are not directly exposed to injurious factors. Thus only 31.7% of the cases where the dermatosis was localized on the hands were allergic, whereas the corresponding figure with respect to localization on the trunk was 50%.

5. Date of Onset.

a. Time of Employment Prior to Onset of Dermatoses.

A great part of occupational dermatoses begin according to most investigators rather soon after a worker has taken up an occupation in which he is exposed to irritating substances. At work he gradually becomes hardened (SCHWARTZ etc.) and besides learns to avoid contact with the injurious substances, with the result that the incidence of dermatoses is lower among older and more experienced workers.

In a proportion of the cases, however, hardening does not take place, but on the contrary hypersensitivity to one or more substances develops gradually. Many investigators, among them SCHWARZSCHILD, BLOCH & STEINER-WOURLISCH, WEDROFF & DOLGOFF and HAXTHAUSEN as well as OLIN in Finland, have demonstrated that sensitization can be brought about experimentally too in human beings and animals. Strongly sensitizing substances (e.g. dinitrochlorobenzene) can cause sensitization within a few days after one epicutaneous application. Such substances, however, are in general avoided in industry just because of this property, and sensitization to the substances commonly employed usually takes a long time, sometimes years or even decades. Most investigators are of the opinion that epidermal allergy, on the basis of which allergic occupational dermatoses usually develop, are always acquired.

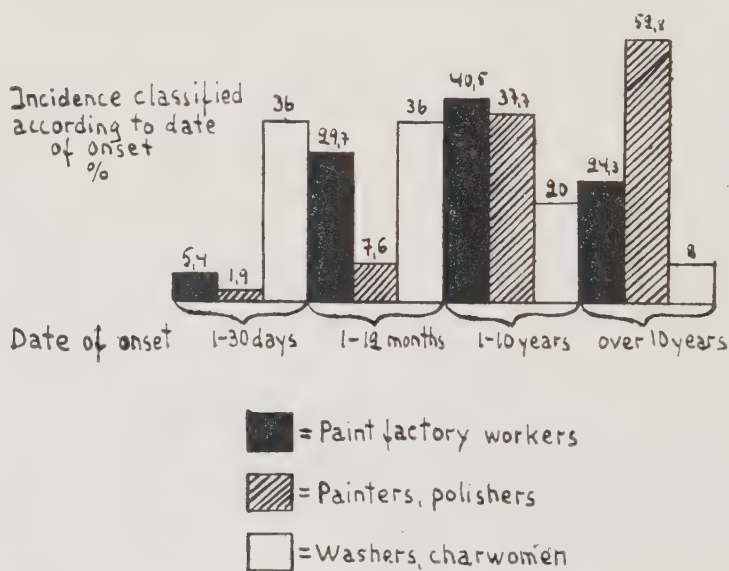
When surveying Tables 16 and 17, we observe that in this material only a relatively small proportion (5.4% and 1.9% respectively) of the cases of dermatosis in paint factory workers (washers excluded) and in painters broke out during the first month.

Table 16.¹

	Total Number of Cases	Time of Employment prior to Onset of Dermatosis			
		1—30 days	1—12 months	1—10 years	over 10 years
Paint factory workers	37 (10)	2 (—)	11 (3)	15 (4)	9 (3)
Painters, polishers ..	53 (17)	1 (—)	4 (1)	20 (9)	28 (7)
Washers, charwomen	25 (6)	9 (1)	9 (3)	5 (1)	2 (1)
Varnishers	4 (—)	1 (—)	3 (—)	—	—
Total	119 (33)	13 (1)	27 (7)	40 (14)	39 (11)

Table 17.

Time of Employment prior to Onset of Dermatitis in Different Occupations.

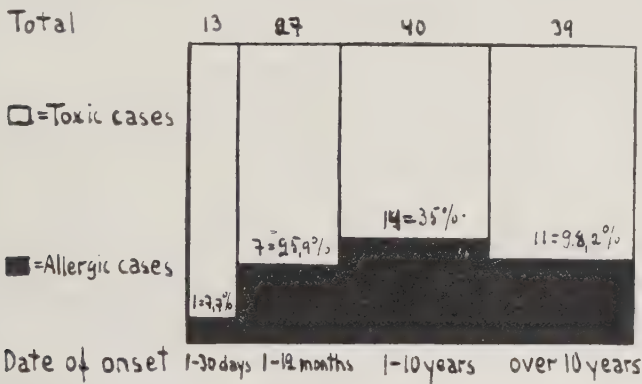


¹ The number of cases with hypersensitivity to occupational substances is given in parentheses.

The proportion of onsets is about the same in the following months. Thus about one third of the dermatoses in the paint factory workers began before the close of the first year, whereas the corresponding number for the painters is one tenth. And the onset occurred in 75.7% of the former and in 47.2% of the latter within a period of ten years subsequent to their beginning work. A much greater difference is noticeable between the former groups and the washers,

Table 18.

Time of Employment prior to Onset of Dermatitis. Allergic¹ and Toxic Cases.



a very considerable proportion of whom (36% of the cases) acquired the dermatosis already during the first month, the majority (72%) before the end of the first year at work.

This numerical relation between the different occupational groups may be seen also in Table 19. It is to be noted that the washers and charwomen had been at work only 2 years before the onset, whereas the corresponding figure with the paint factory workers is 7 years and with the painters and polishers 16 years. Thus we observe that in occupations where there is a greater incidence of dermatosis (washers) it also begins relatively earlier on the average than in the occupations less frequently causing it (painters).

Table 18 shows us that the dermatoses beginning during the

¹ To occupational substances.

first month are almost exclusively toxic. Case 41 of allergic eczema forms the only exception. There too the rapid development of the dermatosis may have been due to the toxic effect of the solvents (the patient was a washer). The fact that allergic eczemas did not begin until the patient had been at work for over a month indicates that in general the patients did not already have hypersensitivity on commencing work but that the sensitization took place due to the effect of the work.

b. Age at Onset.

Onset of dermatosis at different ages is dependent not only upon the nature of the work and individual characteristics but also on the age of the worker when he begins in his occupation. This age varies greatly in the different occupational groups (Table 19), therefore the effect of other factors on the age at which the patient falls ill is rather insignificant. Thus comparison between the groups in this respect is of no notable worth. In most cases the onset occurred at the ages of from 26 to 55 years (Table 20). The relatively small incidence of dermatoses under the age of 25 years depended upon the fact that the mean age at commence-

Table 19.

	Average Age		Average Time of Employ- ment prior to Onset
	at Commencement of Employment	at Onset of Dermatosis	
Paint factory workers	31 y.	38 y.	7 y.
♂	27 y.	35 y.	8 y.
♀	37 y.	42 y.	5 y.
Painters, polishers	23 y.	39 y.	16 y.
♂	21 y.	39 y.	18 y.
♀	29 y.	38 y.	9 y.
Washers, charwomen	♀ 39 y.	41 y.	2 y.
Varnishers	♀ 43 y.	43 y.	2 m.
Total	29 y.	39 y.	10 y.
♂	23 y.	38 y.	15 y.
♀	36 y.	40 y.	4 y.

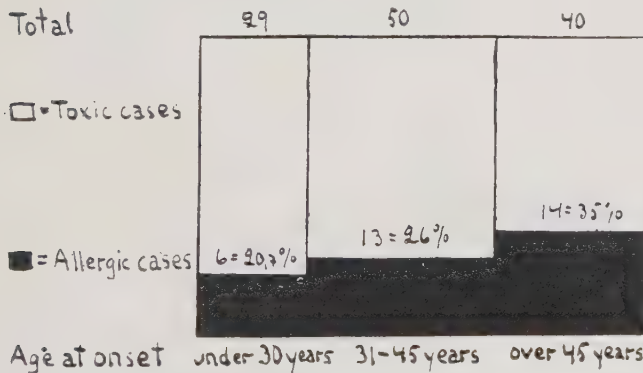
ment of work in the material was rather high (29 y.). That the number of dermatoses appearing at higher ages was relatively great was due in part to the high mean age of the washers at commencement of work.

Table 20.

Age at Onset of Dermatitis	Number of Cases		
	Allergic ¹	Toxic	Total
15—20 years	—	5	5
21—25 "	2	8	10
26—30 "	4	10	14
31—35 "	5	13	18
36—40 "	6	13	19
41—45 "	2	11	13
46—50 "	3	10	13
51—55 "	8	9	17
56—60 "	1	4	5
61—65 "	2	1	3
66—70 "	—	1	1
71—75 "	—	1	1
Total	33	86	119

Table 21.

Incidence at Different Ages. Allergic¹ and Toxic Cases.



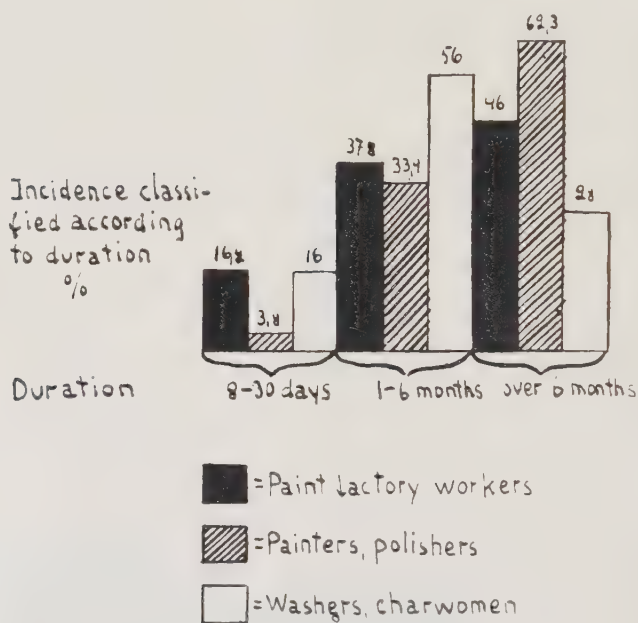
¹ To occupational substances.

Table 22.¹

	Total Number of Cases	Duration of Dermatoses		
		8—30 days	1—6 months	over 6 months
Paint factory workers..	37 (10)	6 (—)	14 (2)	17 (8)
Painters, polishers	53 (17)	2 (—)	18 (3)	33 (14)
Washers, charwomen..	25 (6)	4 (—)	14 (4)	7 (2)
Varnishers	4 (—)	3 (—)	1 (—)	—
Total	119 (33)	15 (—)	47 (9)	57 (24)

Table 23.

Duration of Dermatoses in Different Occupations.



¹ The number of cases with hypersensitivity to occupational substances is given in parentheses.

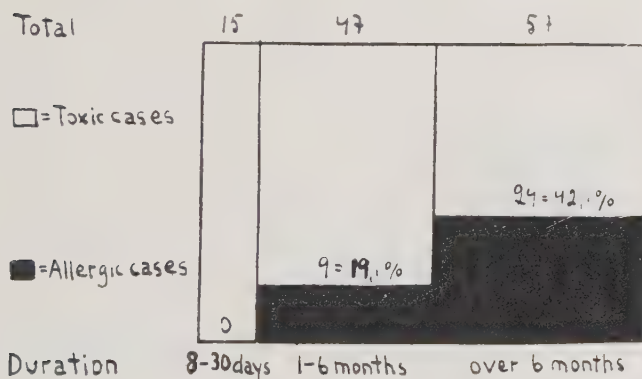
The toxic cases frequently began during the first months subsequent to commencement of work (Table 18) and in general occurred in younger age classes. Thus the relative proportion of the allergic cases seems to increase along with age (Table 21). Moreover older people work more peacefully and their possibilities of avoiding toxic irritants are greater. Therefore it is open to question, whether the relatively great incidence of allergic dermatoses at higher ages may be considered partly due to increase with age of predisposition to sensitization or solely due to other factors mentioned above. However, it is evident that allergic (contact) eczema very often begins even at a high age.

6. Duration of the Dermatoses.

Evidently owing to the continuous irritating effect of the work the dermatosis was generally of relatively long duration (Tables 22—24). Thus in almost 50% of the cases (57) it lasted either unintermittently or intermittently abating for over a half a year altogether. There were only 12.6% (15) of mild cases which cured in one month. When surveying Table 23 we notice that with painters

Table 24.

Duration of Dermatoses. Allergic¹ and Toxic Cases.



¹ To occupational substances.

the dermatosis lasted longer. Already in the paint factory workers there were distinctly less cases of long duration, and with the washers, the difference was even more obvious. This was evidently due to the following factors:

1. The painters generally acquired dermatosis late, after having practised their occupation for several years (Table 19). Then they are already experts in their work and are not willing to change occupation without absolutely urgent reasons. The washer's occupation, on the contrary, does not require special training and this work, in fact, seems to be of a relatively temporary nature just for this reason (the mean age of the washers on beginning work was 39 y.). Therefore the washer on becoming ill is willing to find other work from which she can get the same wages. This, in fact, happened in numerous cases (Table 28), whereupon the dermatosis cured quickly.

2. In the painter's occupation it is easier to protect the skin from paints and solvents than in the other occupations dealt with here. For this reason the dermatosis in general does not become exacerbated so quickly in the painters as in the paint factory workers and particularly the washers, but the former can continue their work despite their dermatosis. However, protecting the skin is not always a complete success, wherefore the dermatosis persists.

Table 25.¹

	Total Number of Dermatitis Cases	Cases of Disability						Number of Cases Hospitalized
		Total		Duration of disability				
		Number	%	1—7 days	8—30 days	over 1 month		
Paint factory workers	37 (10)	19 (7)	51.4 (70)	6 (1)	9 (3)	4 (3)	1 (—)	
Painters, polishers ..	53 (17)	31 (14)	58.5 (82.4)	3 (1)	12 (4)	16 (9)	7 (3)	
Washers, charwomen	25 (6)	11 (3)	44 (50)	3 (—)	6 (1)	2 (2)	1 (1)	
Varnishers	4 (—)	4 (—)	100 (—)	4 (—)	—	—	—	
Total	119 (33)	65 (24)	54.6 (72.7)	16 (2)	27 (8)	22 (14)	9 (4)	

¹ The number of cases with hypersensitivity to occupational substances is given in parentheses.

Table 26.

Duration of Disability in Different Occupations.

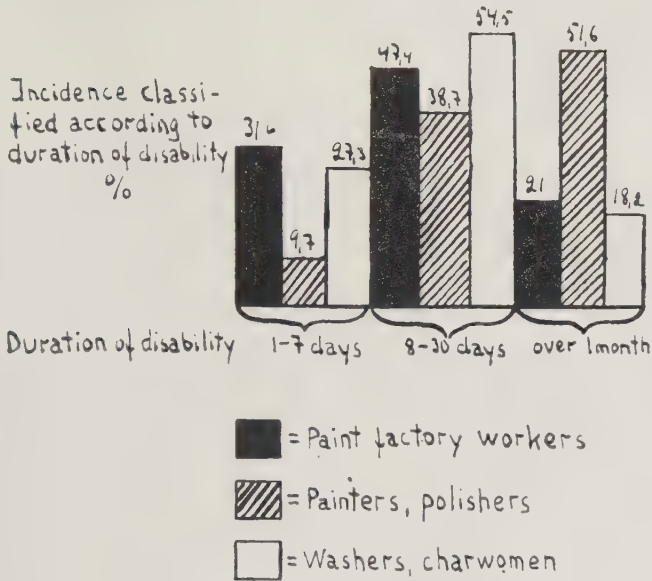
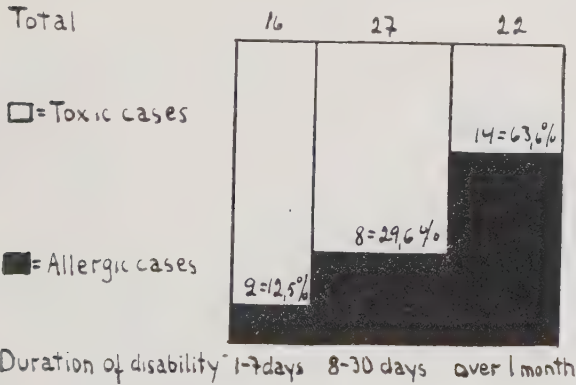


Table 27.

Duration of Disability. Allergic¹ and Toxic Cases.¹ To occupational substances.

3. Moreover, particularly in the painters the dermatosis develops on the basis of allergy (p. 75), and in Table 24 we may observe that the great part of especially the allergic eczemas were of long duration.

7. Disability.

Occupational dermatosis most frequently appears on the parts of the body exposed to the injurious effect of the occupation (p. 81), and when the work once has caused dermatosis, it continues due to the effect of the work, unless the patient can avoid the substance or the other injurious factors causing it. This is often impossible, unless the patient leaves his work. Thus 65 (54.6%) of the 119 patients in this material were obliged to stop working for a shorter or longer period, and besides, 9 patients had to be hospitalized. Earlier we observed (p. 90) that the duration of dermatosis was the longest in the painters. For the same reasons disability caused by the occupation was also of longest duration among them. Thus of the 31 painters, who had to be absent from work, 16 (51.6%) were disabled for over a month (Table 26) and 2 for over a year. Table 25 reveals that the number of painters disabled by dermatosis was relatively greater (58.5%) than that of the paint factory workers (51.4%) and washers (44%).

Table 28.¹

	Total Number of Dermatosis Cases	Change of Work or Occupation				
		Total		Change of work	Change of occu- pation	Temporary Change of Work
		Num- ber	%			
Paint factory workers ..	37 (10)	14 (8)	37.8 (80)	12 (7)	2 (1)	—
Painters, polishers	53 (17)	15 (10)	28.3 (58.8)	3 (—)	12 (10)	3 (—)
Washers, charwomen ..	25 (6)	12 (4)	48 (66.7)	8 (1)	4 (3)	2 (—)
Varnishers	4 (—)	1 (—)	25 (—)	1 (—)	—	2 (—)
Total	119 (33)	42 (22)	35.3 (66.7)	24 (8)	18 (14)	7 (—)

¹ The number of cases with hypersensitivity to occupational substances is given in parentheses.

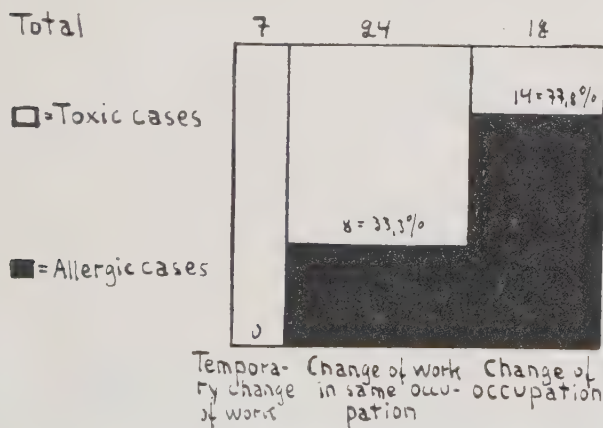
Table 27 again discloses the fact, earlier observed, that the majority of the severe cases of dermatosis were allergic. Thus only 12.5% of the milder cases of dermatosis causing only one week's disability were allergic eczema, but 63.6% of the more severe cases were on an allergic basis. Survey of Table 25 leads to the same conclusion. It reveals that 72.7% of the persons with allergic eczema had to stop working because of their disease, but the corresponding percentage of the total number of patients was considerably smaller (54.6%).

8. Change of Occupation.

Dermatosis usually cures relatively quickly when the patient is absent from work. In many cases, however, there is a relapse soon after return to work. In that case short absence from work is not sufficient, but the patient is obliged to take up other work in which he does not become exposed to the same injurious factors as in his former one. In paint factories, where there are many different kinds of work to be done, a worker can be transferred to other

Table 29.

Change of Work or Occupation. Allergic¹ and Toxic Cases.



¹ To occupational substances.

tasks which his skin tolerates better. A painter, on the contrary, who can no longer do painting work must in general change occupation. This is not so simple, and it involves great expense. Therefore painters usually stick to their occupation until there is no alternative left but to leave it. When taking these facts into consideration (see also p. 90) we can understand that the painters less frequently (28.3%) than the paint factory workers (37.8%) and the washers (48%) changed work or occupation because of dermatosis (Table 28).

The seriousness of the dermatoses is demonstrated by the fact that 35.3% of the cases led to the patient's giving up his work altogether. In addition, 7 patients were temporarily engaged in some other work after recovery (while absent from work).

Table 29 reveals that allergy to substances used at work most often forced the patient to move to other work. As there are only 27.7% of allergic cases in the whole material, 77.8% of the patients who changed occupation had allergic eczema. And Table 28 shows that 22 (66.7%) of the 33 allergic patients had to give up their earlier work permanently.

9. Practical Significance of Epicutaneous Tests.

It is generally known that a positive allergic reaction produced by a certain substance does not prove that it is the causal agent in the dermatosis, but merely indicates that the skin is hypersensitive to it. Only when it is known that the patient during the development of the dermatosis or a little earlier was exposed to it, may the given substance be regarded as the probable causal factor. Similarly, a negative reaction elicited by a given substance does not always prove that it is not the causal agent (p. 73). Despite these limitations patch tests are of a considerable practical significance in many respects, as the tests performed in the cases of this material indicate too.

The allergic cases in my material were in general the most severe ones. Moreover, they formed the majority of those in which changes over broad areas were observed. They also were of the longest duration, caused disability in the greatest number of

cases and compelled the workers to change occupation considerably oftener than toxic dermatitis. By performing skin tests in due time, soon after the onset of the dermatosis, the patient can be assigned work that his skin tolerates, or he can be helped to protect himself against an injurious substance already before the dermatosis becomes severe and causes disability of long duration (e.g. cases 58 and 111). It appears that the most dependable results are acquired when the skin tests are performed with substances used by the patients in their work (case 107). Then, however, a sufficient number of control tests must be done on healthy individuals for the purpose of excluding erroneous interpretation of reactions (case 70).

In addition skin tests can reveal hypersensitivity to a substance used outside work and thus prove that the dermatosis is not due to occupation and therefore does not come under diseases for which compensation must be paid. Frequently hypersensitivity has developed to substances employed therapeutically, which can also be revealed by skin tests, whereupon by giving them up the dermatosis can be cured (e.g. case 71).

Further skin tests may be of advantage in selecting workers for occupations, as for instance for those dealt with here, in which they are exposed to strongly irritating and sensitizing substances. Although hypersensitivity to occupational substances usually develops after a person has begun to practice a given occupation, as this study also demonstrates, it is generally known that (see cases 61 and 111) persons who have become sensitized to one substance later easily acquire hypersensitivity to others too (polyvalent allergy). Thus, if even one of the skin tests done in connection with selection of occupation gives an allergic reaction, there is reason for the person involved to avoid work in which he would be exposed to strongly sensitizing substances.

Obviously toxic reactions have a considerably smaller significance. They may, however, indicate the general or local sensitivity of the skin to toxic irritation (cases 13 and 14). But it is more important perhaps that with the aid of toxic reactions the toxic effect of certain substances used at work can be verified (e.g. case 70), whereupon they can be given up or the workers can avoid handling them. In this respect American investigators have gone so far that,

before a new resin is introduced, they consider it necessary to study its properties of irritating and sensitizing the skin by tests on animals (p. 33).

10. Hereditary and Constitutional Influences.

Hereditary factors are considered to be of significance chiefly in cases of atopic allergy. However, even in them what is inherited is not the allergic disease itself — that is, the clinical type of reaction — but merely the allergic tendency (URBACH etc.). Some statistics show that more than 50% of allergic patients gave positive allergic family histories (SPAIN & COOKE, BRAY, VAN LEEUWEN, etc.), while the population as a whole showed family histories of allergy in only 7—12% of cases or still less (ROST & MARCHIONINI). In this material only three patients (3%) were able to give information of allergic diseases in the family. There were also three patients who reported that they themselves had had other allergic diseases.

Neither was the incidence of dermatoses great in the family histories, reports being made only in a total of 9 cases (7.5%). Four of them had allergic eczema and five toxic dermatitis. It appears that hereditary factors have not had any great effect with respect to the cases included in this material.

Complexion. Blond individuals are in general considered to be more sensitive than others to the irritating effect of chemicals and before all of light. In this material a particularly great incidence of dermatoses was not observed in blond individuals doubtless depending on the fact that the injurious effect of light is a negligible factor in the occupations studied here. 33 of the patients were dark, 69 medium and only 17 blond. The allergic and toxic cases were divided almost evenly among these groups.

Seborrhea. Also seborrheic skin is regarded as being more sensitive to external irritation and predisposed to a greater extent to acne and comedone formation than normal skin. Thus KOEHLER reports that he is of the opinion that individuals with seborrheic skin are not fitted for the painter's occupation. Of the 40 painters and varnishers included in his dermatosis material 15% had seborrhea. In the material treated here a distinct state of seborrhea

was found in only 4 patients (3%), which indicates that such skin changes did not play any particular role in the etiology. This possibly is explainable by the fact, that irritation caused by occupation does not in general involve the areas of the skin where seborrheic changes are present. Neither could it be observed that the course of the dermatosis of seborrheic patients was different from that of the other patients.

Constitutional skin diseases may promote the development of occupational dermatosis, for instance, an excessively dry and easily fissured skin (ichthyotic state) predisposes to epidermal allergization, i.e. eczema allergicum. In this material only one patient was found to have a constitutional skin disease, i.e. psoriasis. This implies that patients suffering from skin diseases of long duration do not in general choose occupations which are known to cause dermatosis exceptionally frequently. In fact, I did not discover a single prurigo Besnier case in my material (Table 30).

Dermographism in the great part of the cases was red. In eight cases it was white on the forehead, but in only two of these it was white also on the arm, and in the others red. No conclusions can be drawn on the basis of this phenomenon with respect to the nature of skin changes in this material.

Table 30.

	Total Number of Cases	Family History		Personal History				
		Skin diseases	Allergic diseases	Nonoccupational dermatitis or eczema	Allergic diseases	Seborrhea	Atopic eczema ¹	Psoriasis
Allergic cases....	37	4	2	1	2	1	—	—
Toxic cases	82	5	1	6	1	3	—	1
Total	119	9	3	7	3	4	—	1

¹ Also termed prurigo diathesique Besnier, eczema pruriginosum allergicum etc.

Table 31.

	Eosinophil Count in Blood				Gastric Analysis: HCl			
	Total	< 5%	5-10%	>10%	Total	<15	16-40	>40
Allergic cases....	17	13	3 ¹	1	18	13	5	—
Toxic cases	32	24	8	—	30	17	11	2
Total	49	37	11	1	48	30	16	2
%.....		76%	22%	2%		63%	33%	4%

Blood count did not disclose anything exceptional but for slight eosinophilia in a part of the cases (Table 31). The number of eosinophils was increased in 24% of 49 patients, in most of them only slightly, the proportion being equal in the toxic cases and allergic ones. One of the latter was found to have considerable eosinophilia (16.5%). In concordance with these results the literature reports (CRIEP, etc.) that eosinophilia has been observed uncommonly often chiefly in patients with atopic allergy (asthma, hay fever, prurigo Besnier or atopic eczema, etc.) but not to the same extent in cases of acquired epidermal allergy.

Gastric analysis. Numerous investigators (EHRMANN, URBACH, REJTÖ etc.) hold that hypo- and anacidity are more frequently present in eczema patients than in normal individuals. Whereas JOHANSSON (1941) on the basis of his material comprising 574 cases of eczema claims that eczema and hypo- and anacidity have no relation to each other. The latter were present in 67.5% of his cases. Gastric analysis was performed in 48 of the cases of my material (Table 31). Hypo- or anacidity was found in the majority of them (63%), particularly in the cases of allergic eczema. It appears that these patients have low HCl values in slightly greater percentage than normal individuals, 54.9% of whom, according to ESKOLA, have hypo- or anacidity, in Western Finland where the living conditions are about the same as those of the patients in this material, which, however, is not extensive enough for drawing definite conclusions with respect to this matter. Neither can it be stated, whether hypo- and anacidity

¹ Tapeworm eggs in stool were found in two cases.

were present prior to the onset of the dermatoses or developed later. Despite the fact that hypo- or anacidity were found in such a great number of patients not many of them complained of stomach-aches.

To summarize it can be seen from these investigations that the patients in this material did not differ with respect to hereditary or constitutional characteristics to any noteworthy extent from normal persons. Neither could the effect of any constitutional factor causing predisposition to occupational dermatoses be demonstrated.

III. Conclusions.

1. Occupational dermatosis is comparatively common among the workers of paint factories and the painters in Finland. Its incidence is relatively the highest among the washers and the lowest among the painters. Within a year (June 1, 1945 to May 31, 1946) 30% of the washers, 10.7% of the other paint factory workers and 3.7% of the painters suffered from dermatoses caused by occupation.

There was no incidence of occupational dermatosis among the workers at the only white lead plant in Finland.

2. Toxic dermatitis and allergic eczema were the most common manifestations of the dermatosis in the occupations in question. In one case there were nail changes only.

3. Finnish sulphate and kiln turpentine were the chief causal agents.

In 26 cases the allergic eczema was caused by turpentine. In some cases hypersensitivity to Bismarck brown, chromium (chromium pigments), phenol formaldehyde resin, wood tar, shellac, colophony or cobalt (siccative) was established. Substances used in the treatment of dermatosis caused sensitization in 8 cases.

Also toxic dermatitis was in most cases caused by Finnish turpentine, the abundant use of which during the war brought about a considerable increase of cases of dermatosis. Aliphatic and aromatic hydrocarbons, lye solutions and whitewash were the causal agents in some cases, other coating materials less frequently.

4. Hypersensitivity to substances occupationally used was

demonstrated in 27.7% of the cases. The incidence of allergic eczema (of the total number of cases of occupational dermatosis) in the different occupations was: 32.2 % in the painters and polishers, 27.0% in the paint factory workers and 24% in the washers and charwomen.

5. In general the allergy was not present at commencement of work but developed due to the effect of it or of the treatment employed for an occupational dermatosis. In only one case the allergic eczema began during the first month, but it is possible that even in this case sensitization caused by the work was involved and the toxic effect of solvents promoted it.

6. The dermatosis was localized in most cases (95.8%) on the hands, either exclusively or elsewhere in addition. For this reason it caused disability in a great part (54.6%) of the cases. The percentage of cases of disability among the painters was relatively the greatest (58.5%). It was also of the longest duration in them persisting for over a month in 51.6%. The percentage of the persons who had to leave their work permanently was 35.3% of all the patients suffering from dermatosis. The majority of these had allergic eczema.

7. The predisposing effect of some particular hereditary or constitutional factor could not be demonstrated with certainty in the material.

The women more easily acquired occupational dermatosis than the men. In the paint factories 29.6% of the women but only 15.4% of the men doing similar work got it. The same proportion seemed to be manifested also in the painter's and polisher's occupations.

Summary.

The author studied the employees of the three greatest paint factories in Finland, ca. 95% of the persons engaged in this occupation in the country, the workers of the only white lead factory in Finland and of 62 painter's firms and painting workshops at Helsinki and Tampere, giving a total of 1,142 persons. A thorough clinical and experimental examination was performed on the workers who were suspected of suffering from occupational dermatosis at the time of study or of having suffered from it earlier.

At first the author briefly presents the classification of occupational dermatoses on the basis of actual causes. Next comes a survey of the most important coating materials (paints etc.) used in Finland. The following section deals with the literature on dermatoses caused by these substances. After general remarks on cases of dermatosis established in dye and paint factory workers and in painters, previous researches on dermatoses caused by dyes and pigments, binders, solvents and the cleansing of the hands are reviewed.

A total of 103 of the 1,142 workers studied had had dermatosis due to occupation. During the course of the examination 16 patients (painters, polishers, varnishers, washers) arrived for treatment from other working places, wherefore the number of cases of occupational dermatosis rose to 119.

The paint factories of Finland are chiefly mixing plants, in which paints and varnishes are produced from pigments, binders, solvents and other ingredients. The workers in them may be divided in three groups according to the nature of their work: 1. Paint workers (177 persons), 2. washers and charwomen (30 persons), 3. outdoor workers and office employees (a total of 171 persons). Relatively the greatest number of occupational dermatoses had developed

in washing and cleaning work, the incidence being 20 cases (66.7%), whereas only 35 (19.8%) of the paint workers and not more than 2 (1.2%) of the remaining 171 had acquired a dermatosis caused by occupation. — Not a single one of the 24 white lead plant workers handling lead, its salts or white lead had had dermatosis due to occupation. — 39 of the 601 painters (6.5%) and 3 (3.6%) of the 83 spray painters had had occupational dermatosis. In only one case the spray painting itself had caused the dermatosis, in the other two it was due to temporary handling of turpentine. — Within a period of one year (June 1, 1945 to May 31, 1946) dermatoses were found in the following percentages (Table 4): 30% of the washers, 10.7% of the paint workers and 3.7% of the painters.

Toxic dermatitis and allergic eczema were the most common manifestations of the dermatoses. In one case there were only nail changes. — In 95.8% of the cases the dermatosis had begun on the hands or the arms, and in the remaining 4.2% the face had been affected first. Similarly the dermatosis was confined chiefly to the hands, arms and face. There were symptoms on the trunk in only 10.1% of the cases, half of which were allergic.

Finnish sulphate and kiln turpentine were the main causes of the dermatoses. The allergic eczema in 26 cases had been caused by turpentine. Moreover hypersensitivity to Bismarck brown, chromium (chromium pigments), phenol formaldehyde resin and wood tar was established twice for each substances. Shellac, colophony and cobalt (siccative) each had caused sensitization in one case. Hypersensitivity to substances used in the treatment of a previous dermatosis had developed in 8 cases. — In most cases the toxic dermatitis had been caused by Finnish turpentine, the abundant use of which during the war had brought about considerable increase in cases of dermatosis. On the basis of results produced by the adhesion chamber method (ROKSTAD) it seems evident that the irritative characteristics of the Finnish turpentine are due to their fractions with a high boiling point (carene, limonene, dipentene). Aliphatic and probably also aromatic hydrocarbons as well as lye solutions and whitewash had also been the causal agents in some cases, but other coating materials less frequently.

Hypersensitivity to substances employed at work could be demonstrated in 27.7% of the cases. Allergic eczema was present in the different occupations as follows: 32.2% of the total number of occupational dermatoses in the painters and polishers, 27% in the paint factory workers and 24% in the washers and charwomen (Table 10).—The hypersensitivity was not present at commencement of work but generally developed later, in some cases due to the effect of the treatment of an occupational dermatosis. In only one case the allergic eczema began during the first month at work (Table 18).

The onset of the dermatosis in the washers and charwomen occurred soon after commencement of work, in 36% of the cases during one month and in a total of 72% of cases during the first year. In only 35.1% in the paint factory workers, on the contrary, the onset of the dermatosis occurred before the close of the first year, the corresponding percentage being not more than 9.5% for the painters and polishers (Tables 16 and 17).

The dermatosis was in general of long duration (Tables 22—24). Thus in ca. 50% of the cases it lasted either unintermittently or intermittently curing for over a half a year altogether. Mild cases, cured within a month amounted to only 12.6%. The dermatosis in the painters was most persistent (Table 23). — Disability was caused in over 50% of the cases. The painters also were disabled for the longest period. Thus 16 (51.6%) of the 31 painters who were compelled to be absent from work were disabled for over a month (Table 26), and two for over a year. — Of all the dermatosis patients 35.3% had to give up their work permanently. The majority of them had allergic eczema.

In fact, when studying the material, it may be observed that the allergic cases were the most severe. Thus the cases, where skin changes appeared over broad areas, were for the great part allergic (Table 15). The allergic eczema was generally of longer duration (Table 24), caused disability more frequently and for a longer time (Table 27) and compelled the workers to change occupation (Table 29) oftener than toxic dermatitis.

The effect predisposing to occupational dermatosis of any hereditary or constitutional characteristic could not be established with

certainly on the material. A greater number of the women were found to have had occupational dermatosis than of the men. Thus in the paint factories in corresponding work 29.6% of the women but only 15.4% of the men had acquired dermatosis.

Résumé.

L'auteur a examiné les ouvriers de trois les plus grandes usines de laques et de couleurs de la Finlande, comprenant environ 95% des personnes exerçant ce métier dans le pays, les ouvriers de la seule fabrique en Finlande de blanc de céruse, ainsi que les ouvriers de 62 ateliers de peintre, domiciliés à Helsinki et à Tampere, ou au total 1,142 sujets. Les ouvriers qu'on a pu soupçonner d'être atteints d'un exanthème professionnel lors de cet examen ou qui avaient eu cette maladie antérieurement ont été soumis à un examen clinique et expérimental minutieux.

Pour commencer l'auteur fait un court exposé de la classification des maladies professionnelles de la peau en raison de leurs causes. Ensuite il donne un compte-rendu des plus importantes matières de peinture utilisées en Finlande. Dans la partie suivante il traite les ouvrages publiés relatifs aux cas d'exanthème dus à ces matières. Après une vue générale sur l'exanthème apparaissant chez les ouvriers des usines de couleurs et des ateliers de peintre il relate en particulier les recherches antérieures sur les maladies professionnelles de la peau causées par les couleurs et les pigments, les substances liantes, les huiles, les dissolvants et le lavage des mains.

Des 1,142 ouvriers examinés 103 sujets au total étaient atteints d'un exanthème dû à la profession. Etant donné qu'il est venu, au cours des recherches, d'autres places de travail encore 16 malades (peintres, polisseurs, vernisseurs, laveurs) le nombre total des cas d'exanthème professionnels constatés s'éleva à 119.

Les usines de laques et de couleurs en Finlande sont principalement des établissements où des couleurs de pigments, de substances liantes, de dissolvants et d'autres matières sont préparées (mélangées etc.). Selon la nature du travail on peut diviser ces ouvriers

en trois groupes: 1. Ouvriers s'occupant de la manipulation de couleurs (177 sujets). 2. Laveurs et nettoyeurs (30 sujets). 3. Ouvriers faisant du travail au dehors et employés etc. (au total 171 sujets). Relativement le plus grand nombre des cas d'exanthème professionnel avait été provoqué par le lavage et le nettoyage, travail dans lequel 20 ouvriers (66.7%) avaient attrapé cette affection, tandis que 35 sujets (19.8%) des 177 ouvriers s'occupant de la manipulation de couleurs et 2 seulement (1.2%) des 171 autres ouvriers étaient atteints d'une maladie de la peau due à la profession. — Pas chez un seul des 24 ouvriers de la fabrique de blanc de céruse s'occupant du plomb ou des sels de plomb une affection de la peau due à la profession n'est apparue. — 39 sujets (6.5%) des 601 peintres en bâtiment et 3 (3.6%) des 83 peintres s'occupant de la peinture au pistolet avaient eu un exanthème professionnel. La peinture au pistolet en soi n'avait produit de l'exanthème que dans un seul cas, les deux autres sujets l'avaient attrapé occasionnellement en manipulant de la térébenthine. — Selon les observations faites au cours d'une année (1. 6. 1945—31. 5. 1946) les cas d'exanthème se répartissent sur les différents groupes comme suit (Tableau 4): Chez les laveurs dans 30%, chez les ouvriers s'occupant de la manipulation de couleurs dans 10.7% et chez les peintres en bâtiment dans 3.7%.

Dans la plupart des cas l'exanthème s'était produit sous forme d'une dermatite toxique ou d'un eczéma allergique. Dans un cas on ne constata que des altérations des ongles. — Dans 95.8% l'exanthème avait commencé soit à la main, soit au bras, dans les autres cas (4.2%) le visage avait été atteint le premier. Ainsi l'exanthème se bornait principalement aux mains, aux bras et au visage. Le torse n'a présenté de symptômes que dans 10.1% des cas, et la moitié en a été de nature allergique.

La cause principale de l'exanthème a été la térébenthine finlandaise, produit distillé du bois ou dérivé de la fabrication de la cellulose. Dans 26 cas l'eczéma allergique a été dû à la térébenthine. De plus l'on constata une hypersensibilité au brun de Bismarck, au chrome (les couleurs chromiques), à la résine au phénol-formaldéhyde et au goudron de bois, dans deux cas à l'égard de chacun de ces produits. La gomme laque, le colophone et le cobalt (le

siccatif) avaient amené chacun dans un cas la sensibilité. Dans 8 cas les substances utilisées dans le traitement de l'exanthème avaient développé une hypersensibilité. — Aussi la dermatite toxique était-elle le plus souvent due à la térébenthine finlandaise, dont l'emploi abondant pendant la guerre avait considérablement augmenté la fréquence de l'exanthème. En raison des résultats obtenus par la méthode «de la chambre d'adhérence» de ROKSTAD il semble que les propriétés excitantes des différentes qualités de la térébenthine finlandaise proviennent des fractions au point d'ébullition élevé (carène, limonène, dipentène). — Les hydrocarbures aliphatiques et aussi, selon toute apparence, aromatiques, ainsi que les caustiques et le badigeon ont également, dans quelques cas, provoqué des exanthèmes, tandis que cela a été plus rarement le cas en ce qui concerne les autres matières de peinture. Souvent l'exanthème a été provoqué par le lavage des mains avec des dissolvants et non par le travail lui-même.

Dans 27.7% des cas l'on constata une hypersensibilité aux matières utilisées dans le travail. Réparti sur les différents métiers l'eczéma allergique était apparu comme suit: dans 32.2% chez les peintres en bâtiment et les polisseurs, dans 27% chez les ouvriers des usines de couleurs, ainsi que dans 24% chez les laveurs et les nettoyeurs de tous les cas d'exanthème professionnel (Tableau 10). — Une hypersensibilité ne s'est développée en général que pendant le travail, ou, dans certains cas, elle a été provoquée par l'effet du traitement utilisé dans l'exanthème professionnel. Dans un seul cas l'eczéma allergique avait commencé au cours du premier mois de l'emploi (Tableau 18).

Chez les laveurs et les nettoyeurs l'exanthème avait en général commencé déjà au début du travail, dans 36% au cours d'un mois et dans au total 72% au cours de la première année. Chez les autres ouvriers des usines de couleurs, par contre, l'exanthème était apparu avant la fin de la première année dans 35.1% des cas et chez les peintres en bâtiment et les polisseurs dans 9.5% seulement (Tableaux 16 et 17).

En général l'exanthème a été de relativement longue durée (Tableaux 22—24). Ainsi, dans presque 50% des cas l'affection a duré au total plus de six mois, soit sans arrêt soit avec guérison

temporaire. Seulement 12,6% des cas ont été bénins, guérissant au cours d'un mois. Chez les peintres l'affection a persisté le plus longtemps (Tableau 23). — Dans 50% des cas l'exanthème avait amené une incapacité de travailler, qui aussi avait été la plus longue chez les peintres en bâtiment. Ainsi, de 31 peintres, qui ont été obligés d'interrompre leur travail, elle a duré chez 16 sujets (51.6%) plus d'un mois (Tableau 26), chez 2 sujets plus d'une année. — De tous les individus atteints d'exanthème 35,3% ont été finalement obligés de quitter leur travail actuel. La plus grande partie de ces cas étaient atteints d'un eczéma allergique.

Par un examen général des cas qui ont été objets de cette étude on constate, que les cas allergiques ont été les plus graves. Ainsi une partie très considérable des cas, où il était apparu des altérations de la peau, s'étendant sur de vastes régions, étaient de nature allergique (Tableau 15). L'eczéma allergique a été en général aussi de plus longue durée (Tableau 24) provoquant plus souvent et pour plus longtemps une incapacité de travailler (Tableau 27) et obligeant plus souvent l'ouvrier de changer de métier (Tableau 29) que la dermatite toxique.

Dans les cas étudiés on n'a pu constater avec sûreté aucune influence prédisposante aux maladies professionnelles, due à une particularité héréditaire ou constitutionnelle. Il fut constaté que les maladies professionnelles de la peau étaient plus fréquentes chez les femmes que chez les hommes. Ainsi 29.6% des femmes dans les usines de couleurs étaient atteints d'exanthème, tandis que le pourcentage des hommes faisant un travail analogue ne s'éleva qu'à 15.4%.

Zusammenfassung.

Der Verfasser untersuchte die Arbeiter dreier grossen Lack- und Farbenfabriken, etwa 95% der dieses Gewerbe Betreibenden in Finnland, die Arbeiter der einzigen Bleiweissfabrik in Finnland sowie die Arbeiter von insgesamt 62 in Helsinki und Tampere gelegenen Anstreichfirmen und Malerwerkstätten, alles in allem 1,142 Personen. Bei den Arbeitern, die auf Grund dieser Unter-

suchung verdächtigt werden konnten, im Untersuchungsaugenblick an Berufshautkrankheit zu leiden oder zuvor gelitten zu haben, wurde eine ausführliche klinische und experimentelle Untersuchung vorgenommen.

Eingangs stellt der Verfasser die Einteilung der gewerblichen Hautkrankheiten auf Grund der Ursachen kurz dar. Dann folgt ein Bericht über die wichtigsten in Finnland benutzten Anstrichfarben und ihre Bestandteile. Im nächsten Teil wird das Schrifttum über die durch diese Stoffe verursachten Hautkrankheiten besprochen. Nach einer allgemeinen Darstellung der bei Arbeitern von Farbenfabriken und bei Malern festgestellten Dermatosen wird über die früheren Untersuchungen über die durch Farben und Pigmente, Bindemittel, Öle, Lösungsmittel und Reinigung der Hände verursachten Hautkrankheiten gesondert referiert.

Unter den 1,142 untersuchten Arbeitern war bei insgesamt 103 ein durch das Gewerbe bewirkter Ausschlag aufgetreten. Da zur Zeit der Untersuchungen ausserdem 16 Patienten (Maler, Polierer, Lackierer, Abwäscher) hinzugekommen sind, stieg die Gesamtzahl der festgestellten Berufshautkrankheiten auf 119.

Die finnischen Lack- und Farbenfabriken stellen neben Bindemitteln (Lacken, Firnissen usw.) auch Öl- und Lackfarben her. Sie reiben Pigmente mit verschiedenen Binde- und Weichmachungsmitteln usw. an. Pigmente werden nur in geringerem Masse bereitet. Ihre Arbeiter können nach der Beschaffenheit der Arbeit in drei Gruppen eingeteilt werden: 1. Farbenarbeiter (177 Pers.), 2. Abwäscher und Reinmacher (30 Pers.), 3. Aussenarbeiter und Angestellte usw. (insgesamt 171 Pers.). Verhältnismässig am meisten traten gewerbliche Hautkrankheiten infolge von Abwaschen und Reinmachen auf, bei welcher Tätigkeit 20 Arbeiter (66.7%) an Ausschlag erkrankt waren, während von den Farbenarbeitern 35 (19.8%) und von den übrigen Angestellten nur 2 (1.2%) an einer durch das Gewerbe verursachten Hautkrankheit gelitten hatten. — Von den 24 mit Blei, seinen Salzen oder mit Bleiweiss umgehenden Arbeitern einer Bleiweissfabrik war bei keinem einzigen eine auf dem Gewerbe beruhende Hautkrankheit aufgetreten. — Unter 601 Malern hatten 39 (6.5%) und unter 83 Spritzlackierern 3 (3.6%) gewerbliche Hautkrankheiten gehabt. Das Spritzlackieren

selbst hatte nur bei 1 einen Ausschlag verursacht, die anderen 2 hatten einen solchen durch gelegentliche Terpentinbehandlung erhalten. — Während eines Jahres (1. 6. 1945—31. 5. 1946) wurde festgestellt, dass Ausschläge folgendermassen (Tab. 4) auftraten: bei den Abwäschern 30%, bei den Farbenarbeitern 10.7% und bei den Malern 3.7%.

Die häufigsten Erscheinungsformen der Ausschläge waren toxische Dermatitis und allergisches Ekzem. In einem Fall traten nur Nagelveränderungen auf. — Bei 95.8% hatte die Hautkrankheit entweder an den Händen oder an den Armen begonnen, bei den übrigen 4.2% war das Gesicht zuerst erkrankt. Desgleichen beschränkte sich der Ausschlag vorwiegend auf die Hände, die Arme und das Gesicht. Am Rumpf waren Symptome nur bei 10.1% der Fälle, von diesen die Hälfte allergisch.

Der finnische Sulfat- und Holzterpentin waren die Hauptursache der Ausschläge. Das allergische Ekzem war in 26 Fällen durch Terpentin verursacht. Ausserdem wurde Überempfindlichkeit gegen Bismarckbraun, Chrom (Chromfarben), Phenolformaldehydharz und Holzteer festgestellt, in je zwei Fällen. Schellack, Kollophonium und Kobalt (Sikkativ) hatten in je einem Fall die Sensibilisierung bewirkt. Gegen die bei der Behandlung des Ausschlages benutzten Mittel hatte sich in 8 Fällen Überempfindlichkeit entwickelt. — Auch die toxische Dermatitis war meistens durch finnischen Terpentin bedingt, dessen reichliche Anwendung während des Krieges eine beträchtliche Vermehrung der Ausschläge im Gefolge hatte. Auf Grund der durch Chambertesten («Adhäsionskammermethode» von ROKSTAD) erhaltenen Ergebnisse scheint es, dass die irritierenden Eigenschaften der finnischen Terpentinarten auf ihren bei hoher Temperatur siedenden Bestandteilen (Karene, Limonen, Dipentene) beruhen. — Die aliphatischen und wahrscheinlich auch die aromatischen Kohlenwasserstoffe sowie Laugen und Kalkanstrich waren in einigen Fällen an den Ausschlägen schuld gewesen, die übrigen Anstrichstoffe weniger. Oft war die Krankheit durch die Reinigung der Hände mit Lösungsmitteln und nicht durch die Arbeit selber bedingt.

Überempfindlichkeit gegen die bei der Arbeit benutzten Stoffe konnte bei 27.7% der Fälle nachgewiesen werden. Bei den verschie-

denen Gewerben trat allergisches Ekzem folgendermassen auf: bei Malern und Polierern 32.2%, bei Arbeitern von Lack- und Farbfabriken 27% sowie bei den Abwäschern und Reinmachern 24% aller Fälle von gewerblichen Hautkrankheiten (Tab. 10). — Die Überempfindlichkeit hatte sich im allgemeinen erst bei der Arbeit oder in einigen Fällen durch die gegen den Gewerbeausschlag angewandte Behandlung entwickelt. Nur in einem Fall hatte das allergische Ekzem im ersten Monat begonnen (Tab. 18).

Der Ausschlag hatte bei den Abwäschern und Reinmachern im allgemeinen bald nach Antritt der Arbeit sich eingestellt, bei 36% im Laufe des ersten Monats und bei insgesamt 72% im ersten Jahre. Dagegen begann bei den übrigen Arbeitern der Lack- und Farbfabriken der Ausschlag vor Ende des ersten Jahres bei 35.1% und bei Malern und Polierern bei nur 9.5% der Fälle (Tab. 16 und 17).

Der Ausschlag ist im allgemeinen verhältnismässig langwierig gewesen (Tab. 22—24). So hat er bei annähernd 50% der Fälle entweder ununterbrochen oder inzwischen heilend insgesamt über ein halbes Jahr gedauert. Leichte, in einem Monat ausgeheilte Fälle haben nur 12,6% ausgemacht. Bei den Malern hat die Krankheit am längsten gedauert (Tab. 23). — Arbeitsunfähigkeit hat der Ausschlag bei über 50% der Krankheitsfälle verursacht. Auch die Zeit der Arbeitsunfähigkeit ist bei den Malern am längsten gewesen. So hat sie unter 31 Malern, die nicht auf Arbeit gehen konnten, bei 16 (51.6%) über einen Monat (Tab. 26), bei zweien sogar über ein Jahr gedauert. — Es haben 35.3% aller an Ausschlag Erkrankten ihre frühere Arbeit endgültig aufgeben müssen. Die meisten von ihnen haben ein allergisches Ekzem gehabt (Tab. 28).

Auch im allgemeinen ist bei Betrachtung des Materials zu erkennen, dass die allergischen Fälle die schwersten gewesen sind. So sind die Fälle, in denen Veränderungen in weiten Hautgebieten aufgetreten sind, zu einem sehr beträchtlichen Teil allergisch gewesen (Tab. 15). Das allergische Ekzem ist im allgemeinen auch langwieriger gewesen (Tab. 24), hat häufiger und länger Arbeitsunfähigkeit verursacht (Tab. 27) und die Arbeiter häufiger zum Berufswechsel gezwungen als toxische Dermatitis (Tab. 29).

Im Material hat ein für Berufshautkrankheiten prädisponierender Einfluss irgendeiner hereditären oder konstitutionellen Eigen-

schaft nicht mit Sicherheit nachgewiesen werden können. Es ist festgestellt worden, dass bei Frauen gewerbliche Hautkrankheiten häufiger aufgetreten sind als bei Männern. So haben in den Lack- und Farbenfabriken in entsprechenden Arbeiten 29.6% der Frauen, aber nur 15.4% der Männer Ausschlag bekommen.

Case Reports and Diagnostic Remarks.

The great part of the case histories presented here in full have been selected with a view to the necessity of giving a thorough explanation of the course of the dermatosis in question. Further, cases referred to in the text and miscellaneous cases of various types are given.

Case 1. H. B. ♂. Eczema allergicum (turpentine).

Anamnesis: A 59-year-old worker at a paint factory reports that he has boiled linseed oil for 37 years without getting any allergic diseases or dermatoses. None have occurred in his family either. Since spring 1944 he has purified sulphate turpentine and has not been able to avoid getting it on his hands. In November 1944 redness, vesicles and itching, later weeping and swelling appeared on his fingers and the backs of his hands. The physician of the factory was of the opinion that the dermatitis was due to turpentine. The patient was absent from work several times for some days, during which time the disease got better, but since it always got worse when he returned to work he was made nightwatchman March 15, 1945 after which the disease has improved notable.

June 6, 1945. Status: General condition rather weak. The patient is of medium complexion. The thickness, moistness and elasticity of the skin are normal. Dermographism rather weak, red.

Redness, scaliness and itching interdigitally and on the backs of fingers from 1 to 4. Vesicles and fissures between the second and third fingers. The skin on the flexor surface of the hands, especially on the fingers is thickened.

Routine tests: turpentine ++. Painters' tests: —. Standard chamber tests: turpentine+++, turpentine fraction 172° +++(+).

The patient is still working as nightwatchman and the dermatitis is gradually healing. March 21, 1946 the skin of the fingers is still red and scaly. October 16, 1946 the dermatitis is almost cured. There is still some cracking sometimes. Patch test: turpentine++.

The patient boiled linseed oil for 37 years without his having any dermatoses. When he began to purify turpentine he did not get the dermatosis immediately but about a half a year later, when the sensitization to turpentine had taken place. After this he could not continue with his former work for the dermatitis always became worse when he returned to work. Even a year and a half subsequent to his quitting the handling of turpentine, the patch test showed distinctly the existence of turpentine hypersensitivity in the patient.

Case 2. F. L. ♂. Eczema allergicum (turpentine).

Anamnesis: A 50-year-old paint factory worker, for 27 years, reports that he has had to perform a great variety of tasks. No family history of allergic diseases or dermatoses. He himself has had asthma for several years which recently has become worse. In 1938 when he was weighing pigments, turpentine and other solvents redness, swelling, vesicles and weeping appeared on his fingers. The eruption cured in a couple of months, when he tried to avoid turpentine. However, the eruption has recurred later several times and he has been absent from work on this account for a total of 5 months. In the winter of 1941—42 he had an eruption on his face too, which he believes to have been caused by turpentine vapours, to which he was exposed when working in the pigment and turpentine storehouse. He wore leather gloves, so the eruption was milder on his hands. During the last half year he has chiefly been working out-of-doors, and the eruption has gradually cured.

January 29, 1947. Status: The only significant findings upon general physical examination are consistent with bronchial asthma. The patient is medium-complexioned. The thickness, moisture and elasticity of the skin are normal. Dermographism weak, red.

The skin of the hands is unusually dry. Cracking particularly on the tips of the fingers. Scaliness and slight rubor on the upper and lower jaws.

Routine tests: turpentine ++(+), soap II. Standard chamber tests: turpentine+++ , turpentine fraction 172° +++.

In this case it is evident that the dermatosis at first developed on a toxic basis, which is indicated by the confinement of the eruption to the fingers and by the recovery despite the patient continuing his work. Because of sensitization which took place gradually the dermatosis began to break forth more easily and it spread elsewhere too. Moreover its curing required stopping work for long periods. Finally the patient had to move to work at which he could avoid the contact with turpentine.

Case 3. A. L. ♂. Eczema allergicum (turpentine).

Anamnesis: A 42-year-old varnish maker, for 20 years, reports that neither he himself nor his family have had any dermatoses or allergic diseases. Nine years ago his hands got hot when he handled some machine and he dipped them in turpentine up to the wrists. The following morning the backs of his hands were very red and swollen. He was absent from work a few days and after that tried to avoid turpentine. But his itching, red and vesicular dermatosis lasted for a long time not healing until he became a foreman two years later. Later too even temporary handling of turpentine has caused redness and itching of his hands. Moreover he claims that turpentine vapours make him sick and give him a pain below the heart.

June 6, 1945. Status: The general physical examination reveals nothing of significance. The patient is of medium complexion. The thickness and elasticity of the skin are normal. The hands are slightly moist. Dermographism normal, red.

The skin between the left thumb and the forefinger is dry and slightly red.

Routine tests: turpentine ++. Painters' tests: —. Standard chamber tests: turpentine ++(+), turpentine fraction 172° ++(+).

In this case the hypersensitivity which had gradually been effected in the patient towards turpentine was obviously still rather weak while the dermatosis was developing, wherefore contact with turpentine to a greater extent than usual was necessary to bring about the onset. Later as the sensitization intensified even the handling of small amounts of turpentine was sufficient to cause or prolong eczema. Possible the burn at onset of the dermatosis promoted the process of sensitization.

Case 4. E. H. ♂. Eczema allergicum (turpentine).

Anamnesis: A 43-year-old worker at a paint factory reports that he was a paint grinder, who had to handle pigments, turpentine and other paint ingredients in his work, in 1940—41 and 1942—44. He used turpentine chiefly to remove paints from his hands. — There is no family history of allergic diseases or dermatoses, nor has the patient had them before. In 1941 after having been at work for about a year he got on his fingers, the backs of his hands and on his wrists redness, swelling, vesicles and itching. The dermatosis lasted several months, until he was recruited. When he returned to work it recurred in 1942. He was absent from work for one month during which he recovered from the dermatosis. However, it appeared again soon after his return to work and lasted without break until 1944, when he was enlisted again. Then the dermatosis healed completely. After the war the patient was employed as helpman of a truck-

driver at the same factory and in this work he has used only little turpentine. The dermatosis has recurred now and then but it has been much milder than before. The physician of the factory has considered that the dermatosis has been due to turpentine.

February 14, 1947. Status: The general physical examination reveals nothing of significance. The patient is rather dark. The thickness, moisture and elasticity of the skin are normal. Dermographism normal, red.

Redness and scaliness on the right thumb and wrist as well as on the knuckles of the left hand.

Routine tests: turpentine ++. Painters' tests: —. Standard chamber tests: turpentine ++, turpentine fraction 172° ++(+).

An eczema due to turpentine hypersensitivity is involved. The patient has had dermatosis owing to this hypersensitivity even when employed as helpman of a truck-driver, wherefore he handles very little turpentine.

Case 6. F. N. ♀. Eczema allergicum (turpentine).

Anamnesis: A 52-year-old filler of paint cans and periodically cooker of floor wax reports that she has been in the former occupation since February 1, 1945. Earlier she has not been employed in similar work. She must wash her hands from 4 to 5 times a day using weak lye solution, potash soap and cold water. She has removed the paint from her hands with turpentine or its substitutes, which make her skin sting. There is no family history of dermatoses or allergic diseases nor has the patient had them earlier. With the exception of «slight heart trouble» the patient has been healthy.

At the beginning of April 1945, after the patient had been at work for over two months, a red, swollen and itching as well as partially papular eruption appeared on the flexor surface of the right arm, whence it soon spread to both hands and arms. On Sundays when she was absent from work the skin always was less irritated but at work again got worse. When she avoided handling turpentine and its substitutes, the dermatosis began gradually to heal.

June 4, 1945. Status: Blood pressure 175/80 mm Hg is the only significant finding upon general physical examination. The patient is rather dark. The thickness and elasticity of the skin are normal. The hands are slightly moist and warm but sweating is otherwise normal. Dermographism normal, red.

The skin of the hands and the arms (to a greater extent of the right arm) is dry and slightly cracking. Moreover there are some redness, fissures and a few pustules on the hands and the backs of the fingers. On the flexor surface of the proximal part of the right forearm there is an area the size

of the palm of the hand where the skin is thickened and there are papules and erosions from scratching. On this area the dermatographism is weak, white.

Routine tests: —. Painters' tests: —.

When the patient was on her vacation from the 9th to the 15th of July, 1945 she recovered from the dermatosis almost completely, but soon after she had returned to work it recurred spreading to her arms, neck and face. After having been absent from work for two weeks she returned again although the dermatosis had not yet healed entirely. About a month later it again spread to the face, and she stayed away from work for three weeks. After that she went back to work for three days again, but as the dermatosis got worse again she left and took employment at a soft drinks factory running a washing machine. Here she has to wet her hands often but she does not have to use lye or turpentine or other solvents. Her skin has been healthy since.

May 14, 1946. Standard chamber tests, right arm: turpentine ++(+), turpentine fraction 172° +++; right thigh: turpentine +(+) , turpentine fraction 172° ++(+).

This patient who had earlier been healthy had when employed as filler of paint cans to handle turpentine and its substitutes when removing paint from her hands and when periodically cooking floor wax. Moreover, she often washed her hands with weak lye solution. Due to the effect of the substances mentioned a dermatitis developed on her hands and arms after she had been at work for about 2 months. The negative patch tests showed that the dermatitis had in the beginning developed on a toxic basis. During a vacation the dermatitis healed almost completely, but soon recurred when the patient was at work again and spread to the neck and arms. She stayed away from work again, whereat the dermatitis improved, but recurred almost as soon as she returned to work. The final recovery of the dermatitis did not occur until the patient moved to work where she did not have to handle turpentine. Renewed skin tests showed that she had become sensitized to turpentine. In this case it is evident that on the basis of the primary toxic dermatitis a specific hypersensitivity to turpentine developed in the patient, which made it impossible for her to continue her former work. Because of this hypersensitivity too the dermatitis gradually recurred more and more quickly after she returned to work and later appeared over wider areas.

Case 7. S. P. ♀. Eczema allergicum (Bismarck brown, wood tar).

Anamnesis: A 41-year-old painter of can closers, who moreover from 1930 to 1935 had to fill cans and bags with aniline dyes, reports that her father had a very dry skin, and her sister, a housemaid by occupation, has had a kind of brown spotted dermatosis on her breasts. Otherwise neither the patient herself nor members of her family have had dermatoses or allergic diseases. She has had a goiter since childhood. In 1935 after being employed in her present occupation for 5 years the patient got on both her hands, mostly on the fingers and the wrists, an itching, red and periodically weeping dermatosis, which the attending physician supposed to be »dye poisoning». She was treated with a salve strongly smelling of tar and having an intensely irritating effect. The dermatosis lasted for two years without break and later too it has appeared in a milder form especially in the winter.

June 20, 1945. Status: The general physical examination and laboratory study reveal nothing of significance. The patient is rather dark. The thickness, moistness and elasticity of the skin normal. Dermographism on the forehead white, and on the arms red.

The skin of the hands and wrists rather dry. Slight cracking on the palms and the backs of the fingers. On the right ring finger and the left middle finger there is a slightly red and scaling eruption.

Routine tests: Wood tar + (+). Painters' tests: Bismarck brown ++, reaction still the same on the eighth day.

August 7, 1945. Renewed patch tests: Bismarck brown ++, wood tar ++ (+).

The patient got a dermatosis on her hands after having handled aniline dyes periodically for five years. It lasted two years and was treated e.g. with tar salve, which she claims only made the dermatosis worse. Since the skin tests show that the patient is hypersensitive to Bismarck brown and wood tar, it is evident that the dermatitis originally developed on the basis of Bismarck brown hypersensitivity, whereas a secondary hypersensitivity to wood tar has caused its continuation. She has had dermatosis later too, which is typical of patients having a polyvalent allergy in the epidermis of the skin.

Case 8. L. L. ♀. Eczema allergicum (turpentine).

Anamnesis: A 54-year-old filler of paint cans for about a year reports that her daughter has asthma. Otherwise there have been no allergic diseases or dermatoses in the family or in the patient. After she had been at work for about three months a red, papular, vesicular and itching eruption appeared on the backs of her hands and on her fingers, whence it spread

to her wrists, face and neck. The physician of the factory believed the dermatosis to have been caused by turpentine. It lasted for about two months not healing until the patient had been absent from work for a month and a half, after which she became a charwoman. Later too when she has temporarily been cooking floor wax she has got a dermatosis on her face and when washing paint cans with turpentine on her right hand and wrist.

June 9, 1945. Status: The general physical examination reveals nothing of significance. The patient is rather dark. The moistness, thickness and elasticity of the skin are normal. Dermographism normal, red.

On the flexor surface of the right wrist there is slightly erythematous, scaly and thickened dermatosis area, 5×5 cm in dimension.

Routine tests: turpentine ++. Standard chamber tests: turpentine ++, turpentine fraction 172° ++. The patient reports that the turpentine tests caused intense pruritus, for which reason she removed them already after about 14 hours. She felt itching at the same time in the skin of her hands.

A typical eczema caused by hypersensitivity to turpentine. The pruritus during the time of the patch tests evidently may be considered a flare-up reaction caused by turpentine.

Case 9. G. H. ♀. Eczema allergicum (turpentine).

Anamnesis: A 39-year-old paint can filler, who was in the beginning employed as washer and has also had to cook floor wax now and then (Cp. case 38), reports that there have been no allergic diseases or dermatoses in her family nor in her either, before she began her present work. About 11 years ago she got a dermatosis on her hands that lasted about two weeks. In December 1944 she cooked wax and the hot turpentine vapours rising from it irritated her skin. After having done this work for a few days an itching, red and partly weeping eruption appeared on her fingers, the backs of her hands and her arms. She was absent from work for a week after which she began to fill cellulose lacquer cans, the dermatosis then healing gradually. She tells that as soon as she has to handle turpentine she gets pimples on her skin.

June 4, 1945. Status: The general physical examination reveals nothing of significance. The patient is rather blond. The thickness and elasticity of the skin are normal. The hands are slightly moist and warm, but sweating is otherwise normal. Dermographism rather weak, red.

The skin of the hands is rather dry, that of the flexor surface of the fingers somewhat thickened and cracking.

Routine tests: turpentine ++(+). Painters' tests: —. Floor wax (100%) ++. Standard chamber tests: turpentine ++, turpentine fraction 172° ++(+).

This employee at a paint factory has during her 22 years at work as washer only suffered from a not severe case of dermatitis obviously of a toxic nature. When she has had, now and then, to handle turpentine on cooking floor wax her skin has gradually become sensitized to turpentine. Therefore she got a dermatosis when again cooking floor wax. It healed when she was absent from work. Later when she changed over to filling cellulose lacquer cans her skin remained healthy. Because of the hypersensitivity even temporary handling of turpentine immediately irritates her skin.

Case 11. L. V. ♂. Paronychia digit. man. amb.

Anamnesis: A 42-year-old colour striker, who has been engaged in his present work, the precipitation of wallpaper pigments, for 12 years, reports that he handles pigments and their raw materials, for instance lead and chromium salts, acids and bases. Almost from the commencement of his present occupation the patient's nail folds have been inflamed, cracking and the nails brittle. The patient supposes the cause to be acids and lye. In 1943—44, when the patient wore rubber gloves, he was cured of the trouble, but it recurred.

June 20, 1945. Status: The hyperacidity of the gastric juice (HCl 62, Ta 82) is the only significant finding upon general physical examination and laboratory study. The patient is medium-complexioned and somewhat freckled. The thickness and elasticity of the skin normal. The hands are slightly sweaty and warm. Dermographism normal, red.

The nail folds of all the fingers swollen and erythematous, and given to cracking. The nails are thin and brittle.

Routine tests: —. Painters' tests: —.

December 10, 1945. The patient has used sulphathiazol salve in the treatment of the nail fold inflammation, and the swelling and redness are milder now than earlier.

February 3, 1947. The nail folds are well, but the nails continue to be brittle, crack and are thinned at the distal end. The distal ends of the third and fourth nails of the right hand are partly detached from the nail bed.

Likely the cause of the dermatitis of the nail fold is the effect of corrosive metallic salts, acids and bases. The changes in the nail plate itself (thinning, cracking, detaching from the nail bed) are partly due secondarily to the inflammation of the nail fold and partly as a primary result to the effect of the foregoing corrosive substances. The same kinds of occupational nail changes have been described by HELLER, OPPENHEIM, PROCHÁZKA, SACHS etc.

Case 12. T. L. ♂. Dermatitis artificialis.

Anamnesis: A 36-year-old assistant to wallpaper printer reports that there have been no allergic diseases or dermatoses in his family or in himself. He has been employed in his present occupation 6 years, his work consisting of handling wallpaper colours and colour paste vats (Fig. 4 and 5). About 3 weeks ago an erythematous and itching, later vesicular dermatosis developed on the thenar of his right hand.

June 20, 1945. Status: The general physical examination and laboratory study reveal nothing of significance. The patient is medium-complexioned. Moistness, thickness and elasticity of the skin normal. Dermographism weak, red.

On the thenar of the right hand the skin is erythematous, thickened, scaly, itching and cracking (Fig. 6).

August 4, 1945. While the patient was away on a two-week vacation the dermatosis healed almost completely, but recurred again.

Routine tests: —. Painters' tests: —.

November 10, 1945. After the patient had protected the site of the dermatosis with a bandage and avoided dirtying it, the disease was cured in three weeks and has not recurred.

The assistant of the wallpaper printer must move the colour paste vat (Fig. 4 and 5). The bottom of the vat always rests on the thenar of the right hand. The mechanical rubbing and the toxic effect of wallpaper colours together cause a dermatosis on this place (Fig. 6). When he has a vacation the dermatitis heals completely, but recurs as soon as he returns to work. When the cause of the dermatitis is explained to the patient, and he protects the site of the dermatosis with a bandage and alters his manner of working somewhat, the dermatosis heals in three weeks.

Case 13. F. L. ♀. Dermatitis artificialis.

A 50-year-old worker at a paint factory reports that she was a filler of oil paint cans from March to September in 1946. From 1935 to 1946 she was a charwoman and now and then had dermatosis for a couple of weeks, which she supposes to have been due to lye solution. At the beginning of May in 1946 she got a red, vesicular and itching eruption on her wrists and the backs of her hands. It lasted for a month and healed when she was absent from work for 11 days and after that did only dry work for about a week. Since her skin seemed to become irritated as soon as she resumed her work of filling oil paint cans, the patient was moved to the packing department. The physician of the factory was of the opinion that the dermatosis was caused by turpentine which the oil paints contained and which the patient also used sometimes in removing stains from her hands.



Fig. 4.



Fig. 5.

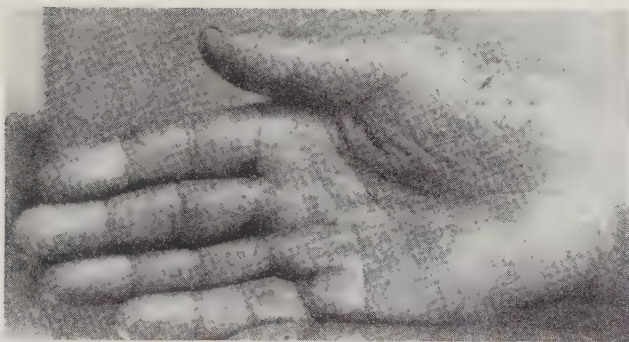


Fig. 6. Case 12.

January 29, 1947 the skin of her hands is unusually dry. There are some reddish papules and erosions left by vesicles.

Routine tests, thigh: «Lysaplast» ++, colophony +++, turpentine ++(+). Standard chamber tests («Poroplast»): «Poroplast» —, turpentine II(I), turpentine fraction 172° II(I).

February 5, 1947. Patch tests, arm («Poroplast»): «Poroplast» —, dammar —, colophony —, shellac II, turpentine II, «Lysaplast» I.

Obviously this patient's skin becomes irritated for various reasons. Thus when cleaning she got dermatoses and later again owing to the toxic effect of turpentine. The reactions elicited by

the skin tests the first time may also be explained as being caused by the unspecific sensitivity of the patient's skin. This is proved by the later negative reaction to colophony and the toxic reaction caused by shellac. The patient did not remember having used adhesive tape before. According to BONNEVIE «Lysaplast» contains dammar and a synthetic substance which is related to colophony. The presence of the latter explains the simultaneous, though as a matter of fact unspecific reaction to colophony and «Lysaplast». The skin test performed with dammar was negative.

Case 14. R. O. ♀. Dermatitis artificialis (1944).

A 27-year-old worker at a paint factory reports that she has been a filler of paint cans for about two years, having previously been at work at the linseed oil plant of the same factory. In the summer 1944 she got a red, papular and itching dermatosis on the backs of her hands, whence it spread to her arms and face. It lasted for about a month sometimes appearing later too in a milder form. The patient herself thinks it was caused by washing her hands with turpentine.

June 4, 1945 the skin of the hands and the arms is dry, that of the palms is distinctly thickened.

Routine tests: —. Painters' tests: —. Standard chamber tests, thigh: —, arm on the site of the earlier dermatosis: kerosene, benzine, sangajol and turpentine II.

This may be a case of a toxic dermatitis due to washing with turpentine. The toxic reactions produced by different solvents depend upon the weakening of the resistance of the skin at the site of the earlier dermatosis.

Case 22. E. A. ♂. Eczema chronicum.

A 34-year-old mixer of paints has been in his present occupation 17 years and must wash the paint mill several times daily with turpentine and tinner. After having been at work two months he got in between his fingers and on the backs of his hands an erythematous, itching and partially vesicular dermatosis, which later spread over his whole body. It lasted about three months and recurred in a less severe form a year later lasting a half a year. During the last two years there has been a mild form of dermatosis on the hands periodically. The patient supposes the dermatosis to have been caused by turpentine.

June 20, 1945. The skin of the back of the hands is dry, on the right hand there is a slightly papular and itching eruption.

Routine tests: —. Painters' tests: —. Standard chamber tests: turpentine fraction 172° I (I).

He has had a dermatosis later too, when washing the machine with turpentine. Naphtha, on the contrary, has not injured the skin.

Case 28. I. K. ♀. *Dermatitis artificialis* (1943).

A 49-year-old wallpaper roller, who has been employed at the same plant for 25 years reports that about two years ago she began periodically to assist the machinist of the priming machine in making of washable wallpapers and she had to handle cellulose lacquers and clean her hands with different kinds of solvents. After a lapse of a few weeks she got an erythematous, papular and itching as well as partly weeping dermatosis on her right wrist and soon also on her arms. It lasted less than a month and recurred soon again when she was at the same work lasting a little longer than the previous time. Both the times the dermatosis healed when the patient went back to her customary work, that of rolling wallpaper.

June 20, 1945 the skin of the fingers is slightly dry.

Routine tests: —. Painters' tests: —.

Case 36. A. B. ♀. *Eczema allergicum* (turpentine).

Anamnesis: A 54-year-old clerk in the office of a paint factory, for 25 years, reports that in 1921—24 she had to handle paint cans and several painting materials in delivering them to customers and for that reason she had to cleanse her hands with turpentine. There is no family history of allergic diseases or dermatoses, nor has she had any earlier. In the winter 1923 she got a papular, red and itching, later weeping dermatosis between her fingers which spread half way up on her upper arms. The dermatosis which both the physician of the factory and the patient herself considered to be due to turpentine lasted for two years and was cured by roentgen treatment. Later the dermatosis has recurred several times when she has handled floor wax and turpentine and has lasted for from 2 to 6 weeks each time. When she walks about in the paint factory she begins to feel a burning sensation in her face.

October 16, 1946. Status: The general physical examination reveals nothing of significance. The patient is of medium complexion. The thickness, moisture and elasticity of the skin are normal. The dermatographism is weak, red.

The hands are healthy. Scaling on the forehead, the sides of the nose and the scalp.

Routine tests: turpentine ++++. Standard chamber tests: turpentine +++, turpentine fraction 172° +++++.

A strong hypersensitivity to turpentine developed in the patient, who earlier had had no dermatoses, during a period of

about two years due to washing her hands with this substance. Later her skin became inflamed also from floor wax when she polished the floor, and even when she merely walked about in the paint factory she felt a burning sensation in her face. In concordance with this also skin test with turpentine caused a strong reaction 23 years after the patient had her dermatosis for the first time and has avoided handling turpentine.

Case 37. Å. T. ♂. *Dermatitis artificialis*.

Anamnesis: A 38-year-old sales manager reports that he has been in his present occupation for 13 years. The work is clean except for the fact that he in examining the quality of turpentine rubs it on his palm, especially of the left hand, in order to find out the presence of impurities on the basis of smell. There have been no allergic diseases or dermatoses either in the patient himself or in his family. In the summer of 1939 an erythematous, vesicular and itching dermatosis appeared on both his palms also spreading to the fingers and the medial side of his feet. At this time the patient was hospitalized at the Dermatological Department of University Hospital in Helsinki (diagnosis: *dermatitis artificialis*) for three weeks, and the dermatitis lasted for almost five months altogether. The patient has continued now and then to handle turpentine as before and the dermatitis has continuously recurred. The patient considers the cause of the dermatitis to be perspiration and turpentine.

September 3, 1945. Status: 6 per cent blood eosinophilia and tape worm eggs in stool are the only significant findings upon general physical examination and laboratory study. The patient is rather blond. Thickness and elasticity of the skin normal. Hands damp and sweating rather abundant. Numerous acne scars on the shoulders and nape of the neck. Dermographism weak, red.

The skin on the left palm and flexor surface of the wrist slightly thickened, red and scaly. Some scaliness on the right palm. Feet, healthy.

Routine tests: —. Painters' tests: —. Standard chamber tests: —, turpentine fraction 172° on the wrist near the site of dermatosis: —.

The patient does not react to turpentine in the concentrations applied. In this case the disease must obviously be considered a toxic irritation caused by concentrated turpentine. This conception is supported by the diagnosis made in the acute stage at the Dermatological Department.

Case 38. E. B. ♀. *Eczema allergicum* (turpentine, primula).

Anamnesis: A 56-year-old charwoman at a paint factory, for 14 years, reports that in her work she must use floor wax, which contains turpentine,

lately 40% sulphate turpentine, and wax as well as some substitutes of turpentine (sangajol, noulene etc.). Her nephew has once had nettle-rash. There have been no other dermatoses or allergic diseases in the family or in the patient. Since November 1944 there has been a red swelling, itching and periodically vesicular and weeping eruption on both her hands whence it spread also to her arms. The physician of the factory supposed the dermatosis to be due to floor wax.

June 6, 1945. Status: The general physical examination reveals nothing of significance. The patient is rather dark. The thickness, moistness and elasticity of the skin are normal. Dermographism rather weak, red.

The skin of the hands and the arms is dry. On both her hands there is a red scaly, itching dermatosis with here and there weeping and crusts.

Routine tests: turpentine + + +, primula + + (+). Painters' tests: —.

March 21, 1946. The skin of the hands has recovered somewhat. It is now dry, red and fissured here and there. Patch tests: primula + +, the reaction appearing after a lapse of three days. Floor wax (100%) + +. Standard chamber tests: turpentine + + +, turpentine fraction 172° + +. Some years ago the patient has had a primula at home, but she did not have a dermatosis then.

As a charwoman at a paint factory the patient must polish the floor with wax containing turpentine. She did not get a dermatosis until after she had done this work for 13 years. The skin tests show that a hypersensitivity towards turpentine has developed, which possibly has partly been due to the fact that at that time e.g. noulene, which contains terpenes to a great extent, was in addition to sulphate turpentine used instead of the earlier sangajol etc. Further it was verified that the patient had hypersensitivity to the primula plant, which must have developed at the time that she had one of these plants at home.

Case 39. S. V. ♀. Eczema allergicum (turpentine).

Anamnesis: A 42-year-old washer, who has done the same work for a few months in 1930 and 1933 and at present for some months, reports that she has to wash vessels containing turpentine with a lye solution. There have been no allergic diseases or dermatoses in the family. After having begun work in 1930 she soon got a red, pimply, vesicular and itching dermatosis on her hands and arms, from where it spread to her breasts and feet. The dermatosis lasted a couple of months healing slowly after she had given up her work of washing. At home too she has often used turpentine, and the dermatosis has recurred frequently. Now that the patient had been again employed for about one month in the same

kind of work as earlier a dermatosis similar to her earlier one appeared on the backs of her hands, later spreading to her arms and to a small extent to her forehead.

June 20, 1945. Status: Except for nonacidity of the gastric juice (HCl —, Ta 8) and marked tremor of the fingers, the general physical and laboratory examinations reveal nothing of significance. The patient is rather dark. The thickness and elasticity of the skin normal. Hands moist and warm. Dermographism normal, red.

On the backs of the hands, to a slight extent on the fingers and more abundantly on the arms, particularly on their flexor surface, there is red, slightly vesicular and itching dermatosis, traces of pustules. On the forehead there is a slightly scaling and dry dermatosis.

Routine tests: Turpentine ++(+). Painters' tests: —.

A typical allergic eczema caused by turpentine. Possibly washing with lye promoted the process of sensitization.

Case 40. A. S. ♀. Eczema allergicum (turpentine, tar).

Anamnesis: A 46-year-old charwoman in the putty and oil paint departments at a paint factory reports that in her work she must use lye solutions and turpentine as well as its substitutes. She has had the same occupation for 15 years and has had her present position since May 1944. Her only son had a dermatosis for 2—3 years, which was held to have been caused by eggs or chocolate. The patient herself has had scarlet fever, diphtheria and the mumps. Especially when she was young she suffered from migraine. She has not had dermatoses before. Since September 1944 she has had a red, itching and vesicular eruption between her fingers, on the backs of her hands and on her arms, and now and then on her face too. The patient supposes the dermatosis to be due to turpentine. She has noticed that floor wax irritates it. For treatment different kinds of salves have been used, one of which smelt of tar; she stopped using this because it seemed to exacerbate the eruption.

February 22, 1945. Status: A solid adenoma the size of the end of the thumb in the right lobe of the thyroid gland is the only significant finding upon general physical examination and laboratory study. The patient is of medicum complexion. The thickness, moistness and elasticity of the skin are normal. Dermographism intense, red.

A dry, red, slightly scaly and itching dermatosis on the forearms, more on the right than the left, on the wrists and to a slight extent on the fingers and the upper arms.

Nevertheless the patient continued her work for over two months and the dermatosis remained the same. When she changed over to dry cleaning work, the eczema healed in a few weeks. Later when the patient had to use floor wax in her work temporarily, the skin of her hands immediately became irritated.

April 25, 1946 the skin is healthy.

Routine tests: turpentine ++(+), wood tar ++, coal tar ++(+). Pain-
ters' tests: —. Standard chamber tests: turpentine +++, turpentine
fraction 172° +++.

The dermatosis is a typical case of eczema due to turpentine hypersensitivity. Moreover, it is obvious that during treatment sensitization to tar also took place.

Case 41. E. K. ♀. Eczema allergicum (turpentine).

Anamnesis: A 43-year-old washer reports that she was occupied at a paint factory from December 1944 to March 1945 and had to use turpentine and other solvents but not lye. There is no family history of allergic diseases or dermatoses, nor has the patient herself suffered from them before. In December 1944 after having been at work for some days, she got on her fingers, the backs of her hands and on her wrists a red, papular, vesicular, itching and later weeping eruption. The physician of the factory considered it to be due to turpentine. When she was absent from work several times for some days, the dermatosis improved but became irritated again at work. Therefore she gave up her work at the paint factory after three months, whereupon she recovered completely. Since that she has been at home, and the dermatosis has not recurred.

February 1, 1947. Status: The general physical examination reveals nothing of significance. The patient is dark. The thickness and elasticity of the skin are normal. Dermographism normal, red.

The skin of the hands is healthy.

Routine tests: turpentine ++(+). Standard chamber tests: turpentine ++(+), turpentine fraction 172° ++(+).

In this case the patient had an eczema owing to turpentine hypersensitivity. She did not recover from it until she had stopped handling this substance. The onset soon after she had begun her work was possibly aided by the toxic effect of solvents.

Case 43. E. A. ♀. Dermatitis artificialis.

A 59-year-old washer reports that she was washing in the oil paint department from March to December 1938 and had to handle turpentine and other solvents. Soon the skin of her fingers, the backs of her hands and her arms got red, cracked and itched. The dermatosis lasted throughout her work at the said department. When she changed over to wash vessels with lye solution and water, it healed. However, in this work too she has had a similar but milder dermatosis.

February 7, 1947 the skin of the hands and wrists is red, dry and rather thin.

Routine tests, thigh: nickel + (+). Standard chamber tests:—. February 10, 1947. Patch test, arm: nickel—. Chamber tests, arm: turpentine and turpentine fraction 172° —.

The dermatitis has obviously developed owing to the toxic effect of turpentine and other solvents. When the patient has washed with water and lye solution her skin has been healthier. The nickel reaction on her thigh (at the site of the nickel buckle of her garter) is evidently an indication of a latent, localized hypersensitivity to nickel.

Case 47. T. J. ♀. Dermatitis artificialis.

A 48-year-old washer at a paint factory, for about four months, reports that after a few days at work she got a papular and erythematous dermatosis on the backs of her hands, wrists, arms and to a slight extent even on her legs, on which during the process of washing up lye solution and thinner spatter. It lasted for several weeks healing gradually while the patient was doing dry work. The dermatosis has recurred when she has been doing washing work again.

June 20, 1945. The skin of the palms slightly thickened, a little cracking. On the hands there are here and there erosions from vesicles. On the arms there are scattered small ulcers (due to corrosion of drops of lye solution?).

Routine tests:—. Painters' tests:—.

Case 58. I. M. ♀. Eczema allergicum (turpentine).

Anamnesis: A 45-year-old washer reports that she has been employed in a floor wax plant for 10 months and has to wash cans with turpentine and acetone. For cleansing her hands she uses a mixture of turpentine and soda solution. There is no family history of allergic diseases or dermatoses, nor has the patient suffered from them earlier either except for not severe nettle-rash now and then. After having been at work for about a half a year at washing cans, she got on her hands a red and papular eruption which subsequently began to weep and spread elsewhere on her upper extremities and to her face. During summer vacation and on Sundays the eruption healed somewhat but became exacerbated as soon as she returned to work. September 27, 1946 she was hospitalized.

September 27, 1946. Status: The general physical examination reveals nothing of significance. She is of medium complexion. The thickness, moisture and elasticity of the skin are normal. Dermographism normal, red.

On the backs of the hands, the forearms and the upper arms, face, and neck there is a not distinctly circumscribed, red, vesicular and

pustular dermatosis. At these sites the skin is rather swollen and scaly in patches.

The dermatosis heals rather quickly in the hospital.

October 10, 1946. Routine tests: turpentine ++. Standard chamber tests: turpentine ++(+), turpentine fraction 172° ++(+), acetone (100%)—.

The patient is in the hospital until November 12, 1946 and goes to work at the factory November 18, of the same year, and she does not have to handle turpentine. She reports however that even the vapours of turpentine cause swelling and redness in her face, wherefore she takes a new employment about a month later.

This is a typical case of dermatosis caused by hypersensitivity to turpentine, which has developed while the patient was washing cans and her hands with turpentine, whereat the alkaline effect of the soda solution also used by her helped forward the process of sensitization.

Case 59. J. V. ♂. Eczema allergicum (turpentine, chromium).

Anamnesis: A 62-year-old painter reports that he has been at his occupation 43 years. His only daughter has had milk-crust for about a year as a child. Otherwise neither the patient nor his family have had dermatoses or allergic diseases. With the exception of a gastric ulcer the patient has been healthy. In 1908 he got a dermatosis on his hands at work. It has continued since then and he has been absent from work frequently because of it for several weeks at a time, whereat it has usually healed but not completely disappeared. At the beginning of November 1945 it spread to his feet. The patient himself supposes that the wet work of washing and hanging wallpaper aggravated the dermatosis. After this he used »Scabinol» salve (benzyl benzoate, sapo kalinus), because the dermatosis itched, but it became worse.

December 29, 1945. Status: The only significant findings upon general physical examination are consistent with symptoms of light heart insufficiency. Blood count, urine and stool normal. Gastric juice non-acid (HCl —, Ta 12). — The patient is of medium complexion. The thickness, moisture and elasticity of the skin normal. Dermographism rather weak, red.

The skin of the backs of the hands and of the fingers red, scaly, thickened and itching, and with some vesicles. On the palms of the hands there are some dispersed dermatosis patches, 1 cm in dimension or less. On the instep of the feet and on the ankles as well as here and there on the toes there is also a red, itching and scaly dermatosis. Fig. 7.

The patient is absent from work for almost a month and the treatment consists of compresses, lotions and mild salves, and digitalis internally.



Fig. 7. Case 59.

The eczema improves so much that he is able to begin his work again avoiding turpentine and wetting his hands, whereupon his skin recovers almost entirely within three months.

Routine tests: turpentine ++, potassium bichromate +++. Painters' tests: —. Standard chamber tests: turpentine +++, turpentine fraction 172° +++. Chromium pigments (repeated) on the arm: —.

This is a typical case of eczema due to hypersensitivity to turpentine. It has troubled the patient for 36 years and got worse every once in awhile obviously owing to his handling turpentine. This time the symptoms were unusually severe because of the unsuitable treatment he gave himself. Furthermore patch tests renewed near the site of the dermatosis disclosed hypersensitivity to potassium bichromate but not to chromium pigments (included in the painters' tests). Despite this fact it is possible that the chromium pigments on affecting the diseased skin have caused sensitization, though they could not (as insoluble pigments) elicit a reaction through the skin test on healthy skin. Another possibility is that the hypersensitivity might be due to leather tanned with chromates (gloves, shoes). This would give an explanation to the appearance of the eczema on the feet, but for the fact that the patient claimed

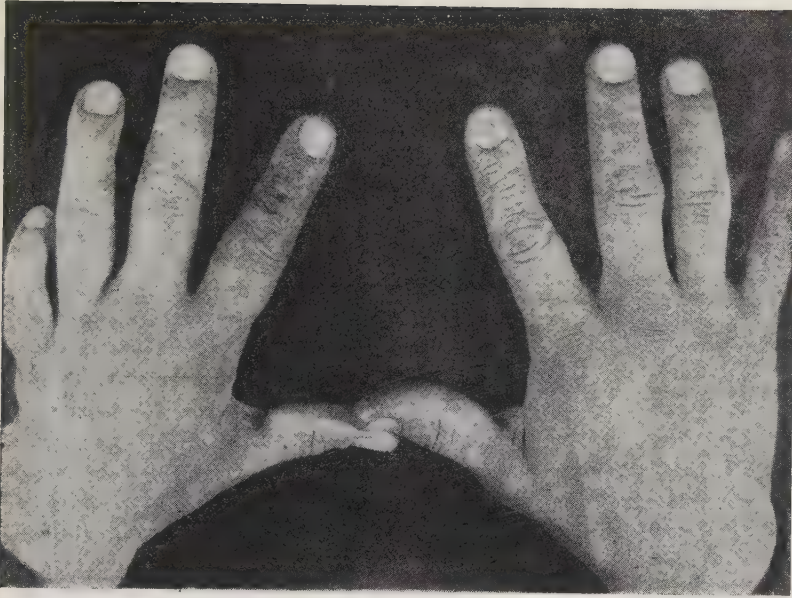


Fig. 8. Case 60.

that he had worn the same shoes three years earlier and again after recovering from the eczema without its recurring.

Case 60. K. T. ♂. Eczema allergicum (turpentine, wood tar).

Anamnesis: A 32-year-old painter reports that he has been at his present work for 14 years and that earlier he has had no dermatoses except the itch in 1943. There is no family history of allergic diseases or dermatoses. In May 1941 he got a red, itching, scaly and in parts vesicular eruption on his fingers and the backs of his hands. It lasted for over 2 months until he left his painting work on being recruited. During leaves he did painting, whereat there was always a recurrence but recovery as soon as he left his work. After the war he resumed his painting work with the result that the dermatosis recurred after about 2 weeks at the end of December 1944. In the summer when he worked with his sleeves rolled up the dermatosis spread to his arms. He is convinced that turpentine or its surrogates are the cause.

September 5, 1945. Status: The general physical examination and routine laboratory study negative. Thickness, moisture and elasticity of the skin are normal. The patient is of medium complexion. Dermographism on the forehead and arm is red in the middle and white on the edges.

The palms of the hands are healthy. The skin in between and on the backs of the fingers is erythematous, scaly and with fissures and vesicles. On the backs of the hands there are infiltrated areas 1—3 cm in diameter here and there, as well as papules, vesicles and pruritus. Fig. 8.

Routine tests, upper arm: wood tar ++. Painters' tests: —. The patient is not aware of ever having handled tar.

September 15, 1945. The patient has not worn his sleeves rolled, and the dermatosis has begun to heal on his arms but is still worse on his hands. He is absent from work from September 15, to Oct. 10, 1945, during which time the dermatosis improves considerably but is not completely cured, though the patient tries to avoid turpentine and other strong irritants.

February 5, 1946. The patient wiped plates the day before with a rag moistened with turpentine in his right hand and now he has small vesicles and edema on the fingers of this hand.

Patch tests, arm at the site of the earlier dermatosis: wood tar + + +, turpentine ++. Standard chamber tests, arm: turpentine +(+), turpentine fraction 172° ++. Chamber test, thigh: turpentine I.

The patient has suffered from his dermatosis later too when at work, whereas during holidays and at the hospital, where he was because of an acute indigestion it has improved very quickly.

In this case the hypersensitivity to turpentine is confined to the places which have been in contact with this substance, wherefore the skin test performed on healthy skin during the dermatosis was negative to turpentine, and a positive reaction was elicited only by making the test at the site of the dermatosis after it was cured. The reactions resulting from turpentine and wood tar were of eczema type. The coincident negative reactions to the other solvents (chamber) on the site of the cured dermatosis confirm the conception of the specific nature of the former reactions. The turpentine test made on healthy skin (thigh) only caused a mild toxic reaction (I). Also the anamnesis indicates that the hypersensitivity to turpentine is a decisive factor in the pathogenesis of the dermatosis. Whereas the cause of the positive tar reaction is not certain. The most probable explanation is that some one of the salves procured by the patient himself contained tar and brought about sensitization.

Case. 61. T. K. ♂. Eczema allergicum (turpentine, Bismarck brown).

Anamnesis: A 60-year-old painter reports that since the year 1922 he has periodically done painting work but since the year 1940 he has chiefly

polished furniture. There is no family history of dermatoses or allergic diseases. In his youth he had typhoid fever and jaundice. In 1938 he got an erythematous, vesicular and itching eruption on his fingers, wrists and in a slight degree on his stomach and it lasted about a year. In 1941 after he had handled more turpentine than usual he again got a similar eruption, which healed in a month after he had changed work. January 2, 1946 an itching, red eruption with small papules again appeared on his fingers, wrists and stomach. Further he reports that in recent years even staying in a room, where turpentine has been used in painting, caused a similar eczema.

January 28, 1946. Status: The general physical examination and routine laboratory study negative. The patient is of medium complexion. The thickness, moisture and elasticity of the skin normal. Dermographism normal, red.

On the flexor surface of the right wrist and round the navel there is an erythematous and partially vesicular dermatosis, and on the left forefinger there is redness and scabiness.

February 4, 1946. Routine tests: turpentine ++, formaldehyde +(), the reaction appeared on the fifth day. Painters' tests: Bismarck brown ++. Standard chamber tests: turpentine ++(), turpentine fraction 172° ++++. Simultaneously with the test reactions the pruritus in the eczema area increased, though the eczema was already well under control (flare-up reaction).

The patient is hypersensitive to turpentine and Bismarck brown. Moreover he has noticed that recently the former has irritated his skin intensely. He has used brown pigments for instance in painting signs, during which the sensitization to Bismarck brown may have occurred. He has polyvalent allergy, wherefore he is inclined to become sensitized to various substances. The delayed reaction to formaldehyde evidently is a sensitization to this substance caused by the patch test.

Case 64. A. K. ♂. Eczema allergicum (wood tar).

Anamnesis: 55-year-old painter, for 33 years, gives no family history of dermatoses or allergic diseases. He has been healthy until 1942, when he was doing tarring work and cleansed his brush from wood tar with benzine, whereat he acquired an erythematous eruption on his hands. Later he scarcely came into contact with any tar and there was no outbreak of the eruption until in July 1943, when for about 2 months he did painting work in a garden using carbolineum and oil paints. There were rubor, papules and vesicles in between his fingers whence they spread to

his arms and thighs. Though he thought the cause to be carbolineum he did not leave off his work, and the eruption became exacerbated. It improved as soon as he stopped painting for two weeks, but final recovery took 3 months.

November 28, 1945. Status: The general physical and routine laboratory studies reveal nothing of significance. The patient is rather dark. Thickness, elasticity and moisture of the skin normal. Dermographism normal, red. The skin is clear.

Routine tests: wood tar ++. Painters' tests: —. Standard chamber tests, arm and thigh: turpentine fraction 172° I. In addition skin tests were made with different kinds of tar in 50% dilution. Carbolineum was not available. Birch tar, pine tar, juniper tar and beech tar +(+).

Evidently the patient became sensitized to tar when painting with it. The toxic effect of benzine helped to promote the development of the primary dermatosis and the hypersensitivity. Correspondingly BONNEVIE, 8% of whose material reacted to wood tar, reported having observed that hypersensitivity to tar most often develops when tar has been used in the treatment of a previous dermatosis or when there is some other factor promoting sensitization (e.g. washing with tar soap). Contact with carbolineum caused a relapse, which is possibly due to the common or closely related ingredients of tar and carbolineum. Carbolineum is a certain fraction of coal tar (a part of anthracene oil), but it must be noted that also some wood tar fractions are erroneously called by this same name.

Case 65. V. L. ♂. Eczema allergicum (turpentine).

Anamnesis: A 40-year-old painter, who has been engaged in his occupation for 21 years, reports no family history of allergic diseases or dermatoses. He himself has been well earlier. In the spring 1945 a red, scaly and itching eruption appeared on the thenar of his right hand and on his right wrist, whence it gradually spread to some extent to the flexor surface of his arm. About on the 23rd of February 1947 the eruption became worse, wherefore the patient arrived for consultation. He considers the cause to be turpentine.

February 25, 1947. Status: the general physical examination reveals nothing of significance. He is dark. The thickness and elasticity of the skin are normal. Hands slightly sweaty. Dermographism normal, red.

Erythema, scaliness and pustules on the right thenar, wrist and flexor surface of the forearm. There are swollen, sore lymph nodules in the right axilla and cubital region.

Routine tests: turpentine ++. Painters' tests: —. Standard chamber tests: turpentine ++, turpentine fraction 172° ++, kerosene II.

The eczema appeared on the basis of hypersensitivity to turpentine, which was the reason for its long duration. The acute exacerbation was a result of a secondary infection.

Case 66. K. L. ♂. Eczema allergicum (phenol formaldehyde resin, wood tar).

Anamnesis: A 46-year-old automobile painter, for 23 years, reports that in his work he has used varnishes and oil paints. There is no family history of allergic diseases or dermatoses. In the late spring 1939 an erythematous, itching and vesicular eruption with subsequent weeping and crusting appeared on his fingers, the dorsum of his hands and on his arms, more on the right than the left, and lasted for about a year until he went into military service. There was a relapse when he returned to work in 1940 which lasted from 4 to 5 months. The patient states that he supposed the dermatosis to have been caused by careless and abundant use of turpentine. Later he has been careful, wherefore his skin has been clear. In recent years he has chiefly used oil paints and has done a lot of tarring; he did not do the latter work at the time of the outbreak of this dermatosis. He does not recall whether he has ever used tar salve.

February 10, 1947. Status: The general physical examination reveals nothing of significance. The patient is rather blond. Thickness, moisture and elasticity of the skin are normal. Dermographism is normal, red. The skin is clear.

Routine tests: wood tar +++, formaldehyde +(+). Painters' tests: Durophen ++. Standard chamber tests, arm and thigh: turpentine fraction 172° I.

The anamnesis indicates that the dermatosis may have first broken out due to the toxic effect of turpentine. The persistence and recurring of the eczema were evidently caused by sensitization to phenol formaldehyde resin (Durophen etc.), which were in general use at that time in Finland as vehicle in volatile varnishes. Being a closely related substance, formaldehyde also elicited a weak skin reaction (Cp. case 98). Since the patient has lately chiefly used oil paints, there has not been a recurrence. The positive reaction to tar seems to indicate hypersensitivity which has just recently developed in tarring work and is still latent. Evidently the patient has not yet been in sufficient contact with tar to acquire a dermatosis.

Case 68. J. J. ♂. Eczema allergicum (turpentine).

Anamnesis: A 33-year-old painter reports that he has been at his occupation for 15 years. His sister had milk-crust as a child. Otherwise there is no family history of dermatoses or allergic diseases. The patient himself has had measles, chicken-pox, scarlet fever and twice a peritonsillar abscess. In the spring 1938 he acquired a dermatosis on his hands which was cured in a couple of months but recurred in the autumn 1939 and subsided again while he was in military service. In the beginning of January 1945, after he had been back at his painting work for about a month, a red, papular and itching dermatosis broke out on his fingers and on the backs of his hands. Later it also began to ooze. It was cured gradually within a half a year when the patient was employed in an office. His opinion is that the dermatosis was caused by turpentine. He mentions that even the vapours of turpentine can bring forth papules on his face.

February 11, 1946. Status: The general physical examination and laboratory study reveal nothing of significance. The patient is of medium complexion. The thickness, moisture and elasticity of the skin are normal. Dermographism normal, red. The skin is now healthy.

Routine tests: turpentine +(+). Painters' tests: —. Standard chamber tests: kerosene I(I), turpentine ++, turpentine fraction 172° ++(+).

This is a typical case of eczema springing from hypersensitivity to turpentine. The history distinctly indicates that the dermatosis always subsided when the patient was absent from work (military service, change of occupation), but reappeared on his using turpentine.

Case 70. K. V. ♂. Eczema allergicum (formaldehyde).

Anamnesis: A 48-year-old painter, who has been in his present occupation for 30 years, reports that there is no family history of dermatoses or allergic diseases. He has often had tonsillitis and tonsillectomy was performed in 1932. About 15 years he had an eruption like the present one on his hands and it has recurred now and then. A few times he took a week's vacation from work, whereat the dermatosis cured. At the beginning of November 1946 vesicles began to appear on the backs of his hands accompanied with itching and redness. Nevertheless he was at work and the eruption got worse. At the time of this outbreak the patient handled turpentine, noulene and oil and spirit varnishes.

December 17, 1946. Status: The general physical examination reveals nothing noteworthy. The patient is medium-complexioned. He sweats abundantly. Dermographism is weak, red.

On the dorsum of both hands there are rubor, small papules and vesicles. On the dorsum of the right hand there is a weeping area ca 5 cm in diameter.

Routine tests: formaldehyde + + +. Painters' tests: —. Standard chamber tests: sangajol III. Patch tests with the substances used by the patient: different kinds of varnishes, red lead and boiled linseed oil (100%) —, turpentine (50%) II, noulene (50%) I. The same turpentine also caused a toxic reaction in two of three control individuals. In the analysis of this turpentine no formaldehyde was found.

January 10, 1947. Patch tests: aqueous solution of turpentine (it contains the water soluble ingredients of turpentine in the same proportion as it) —, formaldehyde 1% + + +, 0.5% +, 0.1 % —.

The patient is absent from his work from December 10, 1946 to January 6, 1947, during which the dermatitis is cured almost completely with compresses and mild salves. February 3rd to 5th, 1947 he is given a 0.5 gram dose of hexamethylene-tetramine three times daily for the purpose of discovering the role played by formaldehyde. It does not have any effect on the skin (no flare-up of the dermatosis is produced).

Earlier too the patient had a dermatosis on his hands while employed as a painter. The hypersensitivity to formaldehyde implies that some of the earlier recurrences may have been due to formaldehyde, which possibly has been contained as an impurity in turpentine. When the present dermatitis developed, it could not be verified that the patient had been in contact with formaldehyde, wherefore it must be considered of a toxic nature. Since reactions were elicited with both formaldehyde and the patient's turpentine, the suspicion was aroused that the turpentine contained formaldehyde, but the presence of 0.5% formaldehyde (= the weakest dilution which produced a reaction) could have been verified analytically. Moreover the reactions of the control individuals and the negative reaction to the aqueous solution of turpentine showed the toxic nature of the turpentine and that this toxicity was due to the ingredients insoluble in water. The negative result got by the experiment with hexamethylene-tetramine confirms this conception. In case 98 in which formaldehyde resin was the causal agent a flare-up of the eczema was produced. By the same method in a few workers using glue containing formaldehyde for conservation, which had caused an eczema, the author elicited strong flare-up of the healed eczema and even brought forth recurrence of old, cured skin reactions.

Case 71. E. L. ♂. Eczema allergicum (balsam of Peru).

Anamnesis: A 65-year-old painter reports that he has been at his present occupation for 44 years. One of his five children has milk-crust and asthma. He gives no other family history of allergic diseases or dermatoses. He has had arthritis. In the autumn 1937 he had an eruption on his hands for over 2 months probably caused by thinner. He was treated at the Dermatological Department of Helsinki University Hospital, the diagnosis being dermatitis artificialis. In March 1943 a rough patch appeared on the

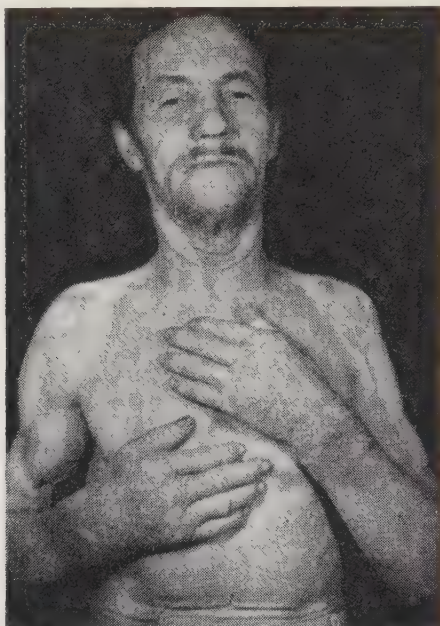


Fig. 9. Case 71.

flexor surface of his right wrist soon spreading to the backs of his hands and fingers and has never completely abated. Since summer 1944 he has treated the eczema with 25% balsam of Peru salve etc., but he claims that especially lately the salve has not felt very good. In the middle of September 1945 the dermatosis spread to his arms, face and body and was of an erythematous, scaly and partially weeping nature. He conjectured, that the enamel paints he has been using recently were the cause of the exacerbation, and continued to use the balsam of Peru salve. The condition became more and more aggravated and he was admitted to the University Dermatological Hospital September 26, 1945.

September 26, 1945 Status: The only significant findings upon the general physical examination are consistent with symptoms of mild emphysema. The routine laboratory study reveals 16.5% blood eosinophilia. The patient is dark. Thickness, moisture and elasticity of the skin are normal. Dermographism is red.

The skin of the dorsum of the hands and wrists is markedly erythematous, desquamative and fissured but with scarcely any exudation. The skin of the upper extremities, face and the upper part of the trunk is less erythematous, itching and slightly scaly. Fig. 9.

October 5, 1945. Routine tests: balsam of Peru ++ (on normal skin of the thigh and November 16, 1945 on the upper arm). Painters' tests: —. The enamel paints, used by the patient before exacerbation (100%) I, weak toxic reactions, which disappear in 1 day.

October 10, 1945 the patient leaves the hospital almost cured, some erythematous, scaly eruption being still left on his hands and wrists. He can however continue his work as a painter when he protects his hands.

May 8, 1946. The dermatosis has persisted to a slight extent. There is slight redness and scaliness on the fingers. Patch test, arm: balsam of Peru +(+). Standard chamber tests, arm: turpentine fraction 172° I.

Evidently the patient acquired a toxic dermatitis from thinner. Sensitization to balsam of Peru took place on the basis of the dermatitis when a salve containing this substance was used, and the eczema continued as long as the patient was using this salve. When the allergen disclosed by the patch tests was given up for him, he was able to continue his work with certain precautions.

Case 72. P. K. ♂. Eczema allergicum (wood tar).

A 39-year-old painter, for 24 years, reports that his sister has had an eruption of long duration on her hands. Since 1936 he himself has had a dermatosis every spring for two months except when he was in military service. A month and a half ago he again got an eruption on the backs of his hands, from where it spread to his wrists. He thought the cause to be frequent washing with cold water. He handled tar to a considerably extent during his apprenticeship about 20 years ago but not at all later.

March 18, 1946 there is an eczema with red papules, vesicles and itching and partly covered with crusts on the dorsum of his hands (Fig. 10).

Routine tests: wood tar +(+). Painters' tests: —. Standard chamber tests: turpentine I (I).

In May 1946 advised by a friend the patient used 10% birch tar salve, which exacerbated his condition greatly and he did not recover until during his summer vacation. Later he has had milder recurrences. February 13, 1947. Patch tests, arm: wood tar ++(+), turpentine —. Standard chamber tests, arm: turpentine I, turpentine fraction 172° I(I).



Fig. 10. Case 72.

Evidently this is a case of a dermatosis springing from a toxic basis. Besides, there is hypersensitivity to wood tar, which seems to have developed 20 years ago when the patient was in contact with it. The tar salve, with which he treated himself, strengthened the hypersensitivity.

Case 73. R. H. ♂. *Dermatitis artificialis* (1938).

A 39-year-old painter, for 17 years, reports that in the summer 1938 when his arms were very stained with enamel paint he rubbed them hard with turpentine and got an erythematous eruption on his left arm, whence it spread to both his wrists and neck and in a small measure to his trunk too. The dermatosis lasted $1\frac{1}{2}$ months, and both the patient and the attending physician were of the opinion that it was due to turpentine. Later the patient has often had barber's itch, which he has treated with different salves — ingredients unknown.

February 18, 1946 the skin is clear.

Routine tests: mercuric chloride ++, adhesive tape +. Painters' tests: mercuric oxide ++. Standard chamber tests: —.

The dermatitis in this case was evidently caused by the toxic effect of turpentine. The positive reactions to mercury were of an allergic type and since they were elicited by both the mercuric salts, they must be considered specific despite the simultaneous, weak adhesive tape irritation. The hypersensitivity probably developed due to the effect of salves containing mercuric salts, which are commonly in treating barber's itch. The patient did not

recall ever having used mercury paints, which are chiefly employed in coating the bottoms of ships.

Case 74. G. W. ♂. Eczema chronicum.

Anamnesis: A 19-year-old painter, who took up his present occupation about 3½ years ago, reports no family history of allergic diseases or dermatoses. As a child he had a rather severe attack of influenza. In March 1944 he acquired a dermatosis on both hands which was cured 5 months later when he was in military service. After resuming work again he was well for over a half a year until the beginning of October 1945, when the skin of the backs of his hands and of his wrists began to get red and itch. Later papules, pustules and weeping developed. Having received x-ray therapy without results, the patient came to the Dermatological Department October 27, 1945.

October 27, 1945. Status: The general physical and routine laboratory examinations give normal findings. The patient seems to be rather retarded and it is difficult for him to grasp the directions given him with respect to treatment. He is blond. The thickness and elasticity of the skin are normal. The hands are moist and rather cold. His skin is rather oily. There are abundant acne formation on his face and acne scars on his back. Dermographism is normal, red.

The skin of the right wrist and the dorsum of both hands is erythematous, swollen and weeping in some places. There are vesicles and some pustules in the border regions. In the left axilla and in the cubital regions there are bean-sized lymph nodes.

Routine tests: —. Painters' tests: —. Standard chamber tests: —.

Though the patient is absent from work the eczema abates very slowly; during this time he is treated with ¼% zinc sulphate compresses, mild salves and x-rays. He does no painting work for 5 months altogether and then changes occupation.

This must be regarded as a case of dermatosis of occupational origin. There was a recovery when the patient was absent from work and relapse when he began it again. The fact that the recovery was slow was doubtless due to the patient's negligence and inability to take care of himself. For the same reason it can be supposed that carelessness at work had helped to promote the development of the eczema.

Case 79. K. O. ♂. Dermatitis artificialis.

Anamnesis: A 59-year-old painter, who has been in his present occupation for 44 years, reports that in June 1944 when doing whitewashing he got red, itching and vesicular dermatosis on his hands. Nowadays he has

not been in contact with lime to any great extent, and the dermatosis has cured gradually.

April 26, 1946 the skin of the hands is dry, slightly red. There are some vesicles.

Routine tests: turpentine I(I), adhesive tape I, slaked lime (moistened with water) —. Painters' tests: cobalt chloride and mercuric oxide I(I). Standard chamber tests: kerosene I, benzine I(I), sangajol II, turpentine I(I), turpentine fraction 172° II. All the reactions disappeared in 2—3 days.



Fig. 11. Case 84.

Evidently the dermatitis developed on the basis of unspecific irritation (possibly lime). The numerous toxic reactions produced by the tests indicate the unspecific sensitivity of the patient to various chemical irritants.

Case 84. M. L. ♂. Dermatitis artificialis.

Anamnesis: A 57-year-old painter, who has been in his occupation for 44 years, reports that in April 1946 he was painting wooden sheds with oil paints and when he worked inside them he was to a great extent exposed to turpentine vapours due to the bad ventilation. In the evenings he had a headache and his eyes were inflamed. After having worked for a week, May 4, 1946, a red and vesicular eruption with swelling broke out on his face, ears and neck.

May 8, 1946. The skin on his both cheeks, on his nose, on the lobe of his right ear and on his neck is erythematous, swollen and itching, with some vesicles and weeping. Fig. 11.

Routine tests: —. Painters' tests: —. Standard chamber tests: turpentine fraction 172° I.

The patient is absent from work from May 4th to 23rd, 1946 during which the dermatitis cures almost completely.

January 29, 1947. Patch tests on the neck at the site of the dermatosis: turpentine —, turpentine fraction 172° —.

Case 95. V. K. ♂ Eczema chronicum.

Anamnesis: A 48-year-old painter and janitor, who was cooking varnish at a paint factory from 1935 to 1942 and subsequently in his present occupation in which he comes in contact with paints, floor wax, turpentine, benzine etc., considers that these substances have an irritating effect on the skin. In the autumn 1942 — he had had his present employment for 4 months — he acquired an itching, red, scaly and slightly papular eruption on his face, which lasted for about 3 weeks and has recurred several times appearing even on the hands and weeping now and then. The patient supposes turpentine or benzine to have some role in its development. Now and then he has taken two or three days off from work but has not noticed any particular recovery during these periods.

June 18, 1945. There is an erythematous, slightly scaly eruption on the right side of the chin, around the nose and on the right eyelid and on the right wrist and the lower part of the right leg.

Routine tests: —. Painters' tests: —. Standard chamber tests: —.

Despite the fact that specific hypersensitivity cannot be constituted on the basis of patch tests, the patient seems to be disposed to get eczema, which for instance the solvents used in the painter's occupation can prolong.

Case 98. V. R. ♀. Eczema allergicum (phenol formaldehyde resin).

Anamnesis: A 47-year-old spray painter, who has practiced her occupation for 10 years, reports that she uses various varnishes, turpentine and its substitutes as well as benzine. There is no family history of allergic diseases or dermatoses. She has been operated twice for goitre, which does not trouble her particularly nowadays. About 20 years ago she suffered from nettle-fever and in 1945 she had paratyphus. In October 1942 she had on her hands, face and trunk an eruption which cured in a week. In December 1944 she again acquired a red, papular and itching dermatosis between her fingers and on the flexor surface of her wrists, where, she claims, most varnish trickles in painting. She thinks that the eruption was caused by black telephone lacquer (43/84) which a little earlier had been taken into use. She continued with her work, and the dermatosis became aggravated spreading in October also to her face. Then she took a vacation.

In the summer of 1945 she also had a vacation and was absent from work because of typhoid fever. Both times the dermatosis cured to a considerable extent but was aggravated again when she returned. When coming for consultation January 31, 1946 she has been absent from work for over three months.

January 31, 1946. Status: In the general physical and laboratory examinations nothing noteworthy is found except the goiter operation scar and that her thyroid gland is rather large and solid. Her blood pressure is 155/90 mm Hg. She is medium-complexioned. Her hands are cold and moist. Dermographism normal, red.



Fig. 12. Case 98.

On the dorsum of both her hands there is an erythematous, purulent dermatosis covered with crusts (Fig. 12).

Routine tests: formaldehyde ++. Painters' tests: Durophen +++(+). Standard chamber tests: —. Substances used by the patient at work: telephone varnish (100 %) +++, thinner (50%) —, the reactions lasted about a month.

The telephone varnish has contained at different times various kinds of phenol formaldehyde resins similar to Durophen, for the most part «Luphen».

March 5, 1946. Patch tests: Luphen (100%) +++(+), Luphen (saturated chloroform solution) +++. The control individuals did not react to these synthetic resins or to the telephone varnish.

The patient was still absent from work for three months, during which the dermatosis cured gradually with the result that she could take up sewing work. The healing continued and after a lapse of an added three months the dermatosis was completely cured.

December 10, to 11, 1946 she took a dose of 0.5 grams of hexamethylenetetramine thrice daily in order that the etiology of the dermatosis might be discovered. Already on the 10th itching and slightly vesicular dermatosis appeared on the knuckles of her right hand spreading on the next day to both her hands and in a milder form to the flexor surface of her elbows. It cured in two weeks.

In this case a spray painter acquired a dermatosis on her hands, which she believes to have been due to telephone varnish. The positive reactions elicited by formalin and telephone varnish pointed to synthetic resin (Luphen) used in making the varnish as the causal agent, and the strong reaction produced by it later verified the accuracy of this conception.

Luphen is the result of the condensation of phenol and formaldehyde. In pure form it should not contain free formaldehyde, which can be discerned by e.g. its odour. The paint factory reported that the synthetic resins imported have not contained any noteworthy amounts of free formaldehyde, wherefore it is likely that Luphen, the reaction to which was stronger than to 4% formalin, was the primary cause of the sensitization. The reaction produced by formalin must in this case be considered a group reaction caused by a related substance. It must be taken into consideration that phenol which is included in the painters' tests, did not produce a reaction. Hexamethylenetetramine, which in the organism decomposes into formaldehyde and ammonia, caused, when taken per os, a flare-up of eruption (Cp. case 70).

Case 101. H. J. ♀. Eczema allergicum (turpentine).

Anamnesis: A 61-year-old washer at a painting firm, for 11 years, reports that she uses a great deal of lye and turpentine. Earlier she was employed at a lime brick factory, where her hands often got «tenders», but cured quickly when she did not have to handle lime. She reports no family history of allergic diseases or dermatoses. When she was 17 years of age she had nettle-rash and a few years later tonsillitis. In 1937 she acquired on the backs of her hands and the flexor surface of her arms a red and itching dermatosis, which lasted several weeks. Later too she has had similar eruptions now and then in a milder form. She has noticed that both turpentine and lye irritate her skin.

January 14, 1946. Status: The general physical examination and laboratory examinations disclose nothing noteworthy. The patient is dark. The thickness, moisture and elasticity of the skin are normal. Dermographism normal red. The skin is rather thick and cracking on the palms of the hands.

Routine tests: turpentine ++(+). Painters' tests: —. Standard chamber tests: sangajol I, turpentine ++, turpentine fraction++.

In this case the eczema has developed on the basis of hypersensitivity to turpentine, the outbreak of which probably has been helped on by abundant use of lye. The fact that the skin earlier was irritated by lime indicates that its resistance to alkaline is rather weak.

Case 105. I. G. ♂. Eczema allergicum (turpentine).

Anamnesis: A 65-year-old painter reports, that he has been in this occupation for 50 years and that there have been no allergic diseases or dermatoses in his family. He had typhoid fever about 1905. In October 1943 an erythematous eruption broke out on his fingers and the backs of his hands, from where it spread to his ears and neck. He was hospitalized for 2½ months, after which he was absent from work. In September 1944 when he returned to work there was a remission of the eczema immediately, wherefore he has chiefly been unemployed. He tried paper-hanging later but with the same result. Moreover he reports that contact with turpentine causes blisters to form on his fingers after a day, but being such an old man he does not want to change his occupation.

March 6, 1946. The general physical examination reveals nothing of significance. Blood count: Eosinophilia 5.5%. Urine analysis negative. Tapeworm eggs in the stool. The patient is dark. Thickness, moisture and elasticity of the skin normal. Dermographism normal, red.

The skin on the hands and on the backs of the fingers, in a greater measure on the right hand than the left, and on the forehead as well as the bridge of the nose is thickened, slightly swollen and scaly.

Routine tests: turpentine ++(+). Painter's tests: —. Standard chamber tests: turpentine +++, turpentine fraction 172° +++. Simultaneously with the test reactions the eczema becomes exacerbated in two fingers.

February 10, 1947. The patient has recently not done painting but only some paper-hanging, wherefore his skin has been healthy. A week ago he painted for a few days whereupon the second and third finger of his right hand began to swell and vesiculate, but began to recover as soon as he left off again.

This is a typical case of eczema due to hypersensitivity to turpentine. The resistance of the skin has become so weak that the patient can get a dermatosis for other reasons too (e.g. wet work like paper-hanging).

Case 106. K. K. ♂. Eczema allergicum (chromium, mercury).

Anamnesis: A 54-year-old painter, for 40 years, reports no family history of allergic diseases or dermatoses. His own health has been good. But for a half a year he has had a red, itching and scaly dermatosis on his left leg, from where it has not spread elsewhere. He has treated it with different salves procured from chemist's shops. About the middle of November, 1945 while painting a red, papular dermatosis began to appear on the backs of his hands and fingers soon spreading to his arms and a little later to his upper arms and thighs. He was of the opinion that it was due to his work but he could not mention any deleterious substance. He began to use zinc salve only and continued working wearing gloves. The eruption on the hands was perhaps slightly improved thereafter but elsewhere it constantly grew worse.

December 15, 1945. Status: The general physical and routine laboratory examinations reveal nothing of significance. The patient is medium-complexioned. Thickness, moisture and elasticity of the skin are normal. Dermographism is normal, red.

There is an eruption with red papules, pruritus and some vesicles on the dorsum of the hands, on the wrists, the arms, the thighs and the left leg and to a certain extent on the trunk. Here and there large, erythematous, swollen and partially weeping areas.

The patient leaves his work and his skin is treated with compresses and mild ointments and, after the condition has become mitigated somewhat, with roentgen rays.

January 2, 1946. The eczema has subsided considerably everywhere. On the leg there is still a small weeping area.

Routine tests: mercuric chloride ++(+), potassium bichromate ++(+). Painters' tests: mercuric oxide ++, chrome green ++, chrome yellow +. Standard chamber tests: turpentine II, turpentine fraction 172° II.

January 29, 1946 the skin is irritated where the patch testing was done, to the greatest extent at the site of the positive reactions.

February 8, 1946. Since the eczema does not noticeably subside when treated at home, he is admitted to the hospital where he is treated for almost 2 months. After this he continues the treatment at home for a month and then is able to begin work as a common labourer. His treatment lasts five months all in all.

February 11, 1947. His skin has remained clear in his new occupation. Patch tests: potassium bichromate ++, mercuric chloride ++, chrome green —, mercuric oxide +++.

It is evident that the patient has an inclination to eczema. It first appeared on his leg, which together with the positive bichromate test leads one to suspect that boot leather tanned

with chromates is the guilty agent. But this is not probable because the patient wore the boots during the skin condition — and still wears — and nevertheless he recovered. The spreading of the eczema to his hands and elsewhere must be held to be due to his occupation. Taking into consideration the foregoing facts, the reactions elicited with bichromate and chromium pigments indicate that the chromium pigments were the cause of the eczema which later broke out on the hands. Unfortunately it could not be found out what paints the patient had used at the onset of the eczema. Since mercuric paints are chiefly employed as coatings for the bottoms of ships, and he had not come into contact with such paints, it is most likely that the hypersensitivity to mercury was caused by the very commonly used salves containing mercuric salts.

Case 107. O. A. ♀. Eczema allergicum (cobalt).

Anamnesis: A 62-year-old painter's assistant, who has done painting work since November 1, 1946, reports that she has used a certain oil paint, boiled linseed oil and turpentine. She has not done housework to any notable extent. There is no family history of allergic diseases or dermatoses. She herself has been well earlier. In the middle of December, when she had been at her present work for 1½ months, a red, vesicular eruption appeared on the back of her hands and her fingers. It soon spread also to the arms and began to weep. During the Christmas holidays it cured to a great extent, but got worse again at work. She believed the cause to be turpentine and stopped working on the 19th of January 1947. Since the eruption did not get better to any great extent, she was hospitalized on the 28th January 1947.

January 28, 1947. Status: The general physical examination reveals nothing exceptional. She is medium-complexioned. The thickness and elasticity of the skin are normal. The hands are unusually moist. Dermograpism normal, red.

The skin of the fingers, dorsum of the hands and distal parts of the arms is swollen and erythematous. Vesicles and weeping. Fig. 13.

February 5, 1947. Routine tests, thigh: —. Standard chamber tests: —. Oil paint used by her (50%) ++. Turpentine used by her (50%) —.

The ingredients used for the making of the oil paint are supplied by the paint factory in question. Patch tests are performed with them on the thigh on the 20th of Feb. 1947: Pigments (moistened with water) —, siccative (25% dilution in castor oil) +++, boiled linseed oil (50%) ++(+), castor oil: —, cobalt chloride (10%) +++, (5%) ++(+), tall oil —. The siccative is a mixture of turpentine and cobalt salts.

The patient is in hospital from Jan. 29, 1947 to Feb. 19, 1947, during which time the dermatosis abates to a considerable extent. But she is not yet fit for work. After complete recovery she intends to change work.

In this case the patient became sensitized to cobalt which the oil paint used by her contained as a siccative. Cobalt is used for this purpose in the form of fatty acid and resin acid salts. There was siccative in both the boiled linseed oil and oil paint used by her, which explains the positive reactions to both these substances.



Fig. 13. Case 107.

This case indicates distinctly that patch tests made with substances used by a patient himself can quickly bring to light the causal agent in a case of allergic eczema. Painters' tests were not performed, because it was unnecessary. However, the cobalt chloride contained in them would also have revealed the etiology of the eczema.

Case 111. S. H. ♀. Eczema allergicum (shellac, colophony).

Anamnesis: A 31-year-old polisher of furniture, for 11 years, reports that she uses a polishing ball moistened with polish or thinner and besides she uses various varnishes. She gives no family history of allergic diseases or dermatoses and herself has had no illnesses except inflammation of the ovaries, which still troubles her. At the end of October 1945 she had especially often to polish furniture subsequent to varnishing. Then a red and vesicular dermatosis appeared on the palm of her right hand and on her fingers in places that the polishing ball moistened with thinner touched.

About 3 weeks later the dermatosis spread to her arm, and when she tried to do her work with her left hand it appeared there too and also on her left arm.

November 30, 1945. Status: The general physical and laboratory examinations reveal nothing noteworthy. She is rather blond and has some freckles. The thickness, moisture and elasticity of the skin are normal. Dermographism on the arm is normal, red, on the forehead red with white borders.

There is an erythematous, itching and vesicular dermatosis on the right palm and the fingers where the patient has held polishing ball. There is a similar but milder dermatosis on the flexor surface of both her arms and on the dorsum of her hands. On her face round the nose the skin is erythematous.

Routine tests: —. Standard chamber tests: turpentine I, turpentine fraction 172° I, Thinner —, two kinds of polish used by the patient at work +(+).

The patient is absent from work for two weeks, whereupon the dermatosis cures gradually. She is transferred to drier work, and her skin remains healthy. Now and then she tries to do polishing work but her skin always becomes irritated.

November 12, 1946 there is an erythematous and vesicular dermatosis only on the fourth finger of the right hand. After the factory reports that the substances used by the patient contain shellac (brown spirit varnish about 20% of it and the polishes about 10%) the following additional patch tests are made:

Brown spirit varnish ++(+), polish ++(+), shellac +++, colophony ++, dammar —, pyridine —, denatured alcohol —, turpentine II. The control tests performed with the varnish and polish on ten individuals are all negative. Simultaneously with the reactions the dermatosis is considerably exacerbated and spreads to the fingers of both hands (flare-up reaction) without any other verifiable reason. The curing of the dermatosis and the shellac reactions takes about a month.

In this case a polisher of furniture acquired dermatosis when she had to use more thinner than usual. It is obvious that in the beginning a toxic dermatitis caused by this solvent was in question; it was confined to the parts of her skin which had been in contact with the thinner. When she came for treatment the dermatitis was already spread over a more extensive area and patch tests indicated that sensitization had taken place. However, even then colophony, included in the routine tests, gave a negative reaction. The patch tests performed about a year later showed that the reac-

tions caused by varnish and polish were due to shellac. Moreover within the year hypersensitivity to colophony had developed; this was also used as an ingredient in furniture varnishes owing to shortage of shellac.

Case 115. M. T. ♀. Dermatitis artificialis.

Anamnesis: A 32-year-old furniture polisher, for about 2 years, reports no family history of allergic diseases. She is the eldest of six children, one of whom had dermatosis when employed at a bakery, and another of whom



Fig. 13. Case 115.

had a similar dermatosis when employed as a waitress. The patient has earlier been healthy with the exception of chronic cold in the nose. In October 1945 she had a dermatosis with red papules and crusts on the base of and in between the fingers of her right hand. Since January 4, 1946 she again has had similar dermatosis also on her fingers. She believes that it was caused by polishing substances.

January 12, 1946. Status: The general physical and laboratory examinations reveal nothing exceptional except for 5.5% eosinophilia in the blood. The patient is rather dark. The thickness, moisture and elasticity of the skin are normal. Dermographism normal, red.

On the knuckles and the backs of the fingers of the right hand there are erythema, scaliness and crusts, as well as traces of vesicles. Fig. 13.

Routine tests: paraphenylenediamine $+(+)$, appears on the 5th day. Painters' tests: —. Standard chamber tests: kerosene I, sangajol II, turpentine I, turpentine fraction 172° I.

She is absent from work from January 9, to February 3, 1946, during which the dermatosis cures almost completely. After that she becomes a cashier of her own accord, and her skin remains healthy. Two months later, however, washing clothes with powders causes the dermatosis to recur, but in a milder form.

The dermatosis in this case may be considered toxic dermatitis on the basis of the anamnesis, the typical localization (right hand) and the symptoms. The toxic reactions produced by various solvents confirm this conception. Being an individual susceptible to toxic effect the patient later acquired dermatosis due to washing clothes (washing powders?).

Case 116. L. V. ♀. Dermatitis artificialis.

Anamnesis: A 54-year-old varnisher of electric leads, who has practiced her present occupation for about 2 years, reports no family history of allergic diseases or dermatoses, but that she once had nettle-fever as a child. At work she varnishes insulating tubes and washes iron parts with thinner and denatured alcohol. Earlier this work did not cause dermatosis, but since September 1945 a new varnish has been used at the factory which does not dry in room temperature, wherefore the varnished insulating tubes must be dried in a special oven having a temperature of about 80° C. The patient has to stay in the drying oven for several minutes and is exposed to varnish vapours with the result, that often subsequently she has had an itching sensation in her skin and her eyes smarted. Since about November 5, 1945 she has had a red, slightly swelling, itching dermatosis on her face and arms, which are not covered by clothing. She has a tight *béret* which covers her ears partly, and the skin protected by it has remained healthy. On Sundays, when she is not at work, the itching abates.

December 3, 1945. Status: The general physical and laboratory examinations reveal nothing exceptional. She is rather dark and has some freckles. The thickness, moisture and elasticity of the skin are normal. Dermographism on the forehead is very weak and indistinct, on the arm weak and white.

There is rubor and pruritus on the face and arms. Further, there are traces of scratching on the skin of the arms.

She tries to stay at work using zinc liniment to protect her skin, but since the dermatosis becomes exacerbated she moves to dry common labourer's work on December 13, 1945, whereupon she begins to recover at once.

December 20, 1945. Routine tests: —. Thinner, denatured alcohol and varnish (100%) —, benzine (60%) —. The spirit is denatured by methyl alcohol. The varnish consists of about 40% of alkyd resin, as well as benzine, alcohol and a little (ca 3%) turpentine as solvents.

January 3, 1947 another kind of varnish is introduced, wherefore the patient returns to her former occupation without getting a dermatosis again.

. Case 117. S. S. ♀. Dermatitis artificialis.

Anamnesis: A 25-year-old insulating worker, who varnishes electric leads since September 15, 1945 (Cp. case 116), reports that there have been no allergic diseases or dermatoses in her family but she herself had nettle-fever for a few days as a child. On November 3, 1945 an itching, red and slightly swelling dermatosis appeared on her face and hands. Her arms covered by sleeves and her ears covered by a kerchief were not affected.

December 3, 1945. Status: The general physical and laboratory examinations reveal nothing exceptional. The thickness, moisture and elasticity of the skin are normal. She sweats a little more than is usual. Dermographism on the forehead is rather strong, white and on the arm red with white borders.

On the face and hands there are slight rubor, swelling and pruritus. On the hands there are traces of scratching.

The patient tries to stay at work using zinc liniment to protect her skin, but as her dermatosis does not cure she moves to dry work on December 13, 1945, whereafter it cures completely in a week.

December 20, 1945. Routine tests: —. Thinner, denatured alcohol and varnish (100%) —, benzine (60%) —.

When a new varnish is introduced the patient continues her former work without a recurrence of the dermatosis.

Case 118. S. R. ♀. Dermatitis artificialis.

Anamnesis: A 39-year-old worker, who has insulated electric leads since October 1, 1945 — the same work as cases 116, 117 — but has done other work for about a half of each day, reports that there have been no allergic diseases or dermatoses in her family. She herself acquired a red, itching and swelling dermatosis on her face and neck on December 4, 1945, when she was in the drying oven unusually long and besides went to warm herself there in the morning on coming to work.

December 5, 1945. The general physical and laboratory examinations reveal nothing significant except 7.5% eosinophilia in the blood. She is medium-complexioned. The thickness, moisture and elasticity of the skin are normal. Her hands are cold. Dermographism normal, red.

The skin on the face and neck in parts unprotected by clothing is erythematous, itching and slightly swollen.

The patient continues to do the same work a part of the day using a lotion to protect her skin. While at work she feels that the itching becomes more intense, but the dermatosis cures gradually.

December 20, 1945. Routine tests: —. Thinner, denatured alcohol and varnish (100%) —, benzine (50%) —.

February 26, 1946. Recently she has used the same varnish at work but has not been in the drying oven, and she has been healthy.

At an electric equipment factory a varnish containing alkyd resin is introduced for insulating tubes for electric leads. This varnish must be dried in a special oven. Thereupon three (cases 116, 117 and 118) of the four varnishers doing this work acquire dermatitis, which appears everywhere on the skin where it is not protected by clothing. The patch tests show that hypersensitivity to the varnish or other substances used at work by the patients is not involved. In investigating the etiology additional patch tests were made with the varnish so that prior to applying the patches the skin was heated with an electric pad for 5 minutes. Thereupon a weak toxic reaction (I) was produced in all three dermatitis cases, whereas no reaction was produced in the fourth worker, who had not suffered from this disease. Tests performed on 4 control individuals also were negative. This series of tests as such is not absolutely dependable as evidence, but it, nevertheless, indicates that the persons who got dermatosis at work are more sensitive to the toxic effect of the varnish than the healthy test individuals. (Note also the exceptional dermographism.) It must be considered evident that these are cases of toxic dermatitis caused by warm varnish vapours (alkyd resin?). This conception is supported by the fact that two patients (116 and 117) can varnish insulating tubes without falling ill when a varnish is again in use which dries in room temperature and that the third patient (118) can handle the same varnish when it is used for a purpose where a high temperature is not necessary for the drying. KLEEGER has reported a corresponding case (see p. 33).

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